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TEST EXCAVATIONS ON THE HEADLAND PA AT KAURI POINT, BIRKENHEAD, AUCKLAND, IN 1971

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Abstract. Limited excavations in the interior of a headland pa at Kauri Point, Birkenhead (N42/27; R11/35), revealed signs of brief and transitory occupation, despite the strategic position of the site. This may have been due to the lack of good gardening soils in the vicinity. The small stone assemblage recovered from the excavations shows that the inhabitants were importing raw material for oven stones and tools from a number of sources. Midden deposits consisted mainly of local estuarine shellfish. Very few fish bones were found despite the traditional importance of the area for fishing.

This paper describes test excavations carried out on the headland pa, N42/27 (R11/35), at Kauri Point, Birkenhead. The excavations took place at Easter 1971, under the auspices of the Auckland Institute and Museum, and at the request of the Auckland Harbour Board, owners of the land, who were anxious to establish the significance of the site.

THE SETTING

The site occupies a prominent headland (Fig. 1) on the eastern side of Kendall Bay, on the north shore of the Waitemata Harbour. The deep water of the main harbour channel reaches almost to the foot of the site, although Kendall Bay itself is shallow and tidal. The western side of Kendall Bay is bounded by the higher ground of Kauri Point proper, and beyond this the harbour widens towards its upper reaches. The site occupies a strategic position on the channel, overlooking the approach to the upper harbour.

The headland itself offers an almost ideal setting for a fortified site (Fig. 2). A roughly triangular flat area is bounded on two sides by cliffs about 30 m high, and on the third by a steep slope ending in a smaller cliff at the base. The main approach is along a fairly level but narrow and winding ridge from the north. At the point where the narrow ridge widens to become a flat-topped headland, the natural defences have been strengthened by artificial earthworks. These take the form of two incomplete ditches dug from opposite sides of the ridge, with a steep high scarp on the southern side. It is also possible to reach the site up a steep track from Kendall Bay or, with great difficulty, by scrambling up the cliff on the east side. Both these approaches, however, reach the ridge top in the vicinity of the ditches and outside the defensive scarp.

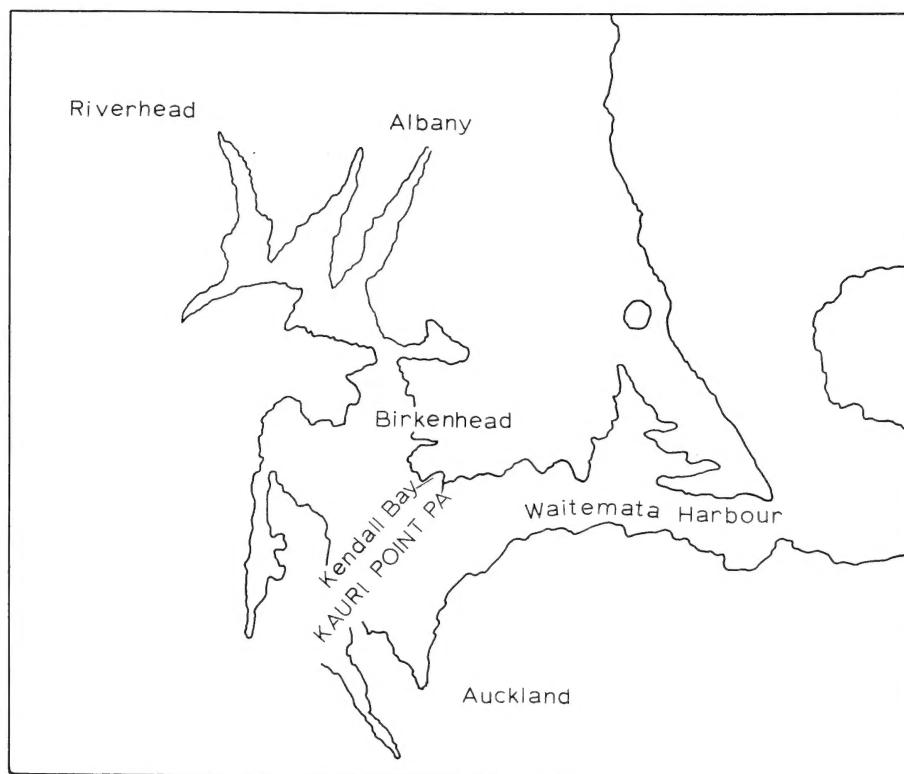


Fig. 1. The location of the pa at Kauri Pt.

The land in this part of the north shore is composed of sandstones of the Waitemata Group (Ballance 1976). The soils developed on these rocks under kauri forest are poor and the area is unlikely to have been attractive for prehistoric horticulture. On the other hand, the marine resources would have been excellent. Estuarine shellfish are to be found at Kendall Bay and elsewhere in the vicinity; rock oysters were probably abundant on the intertidal rocks, and the deep channel would have been an immediate source of fish. There is fresh water, but very little flat land, in Kendall Bay.

TRADITIONAL HISTORY

The names of three pa have been recorded in the general area of Kauri Pt. Unfortunately, the principal authorities disagree about the locations of these pa, and it is by no means certain which name or names refer to the site under consideration here.

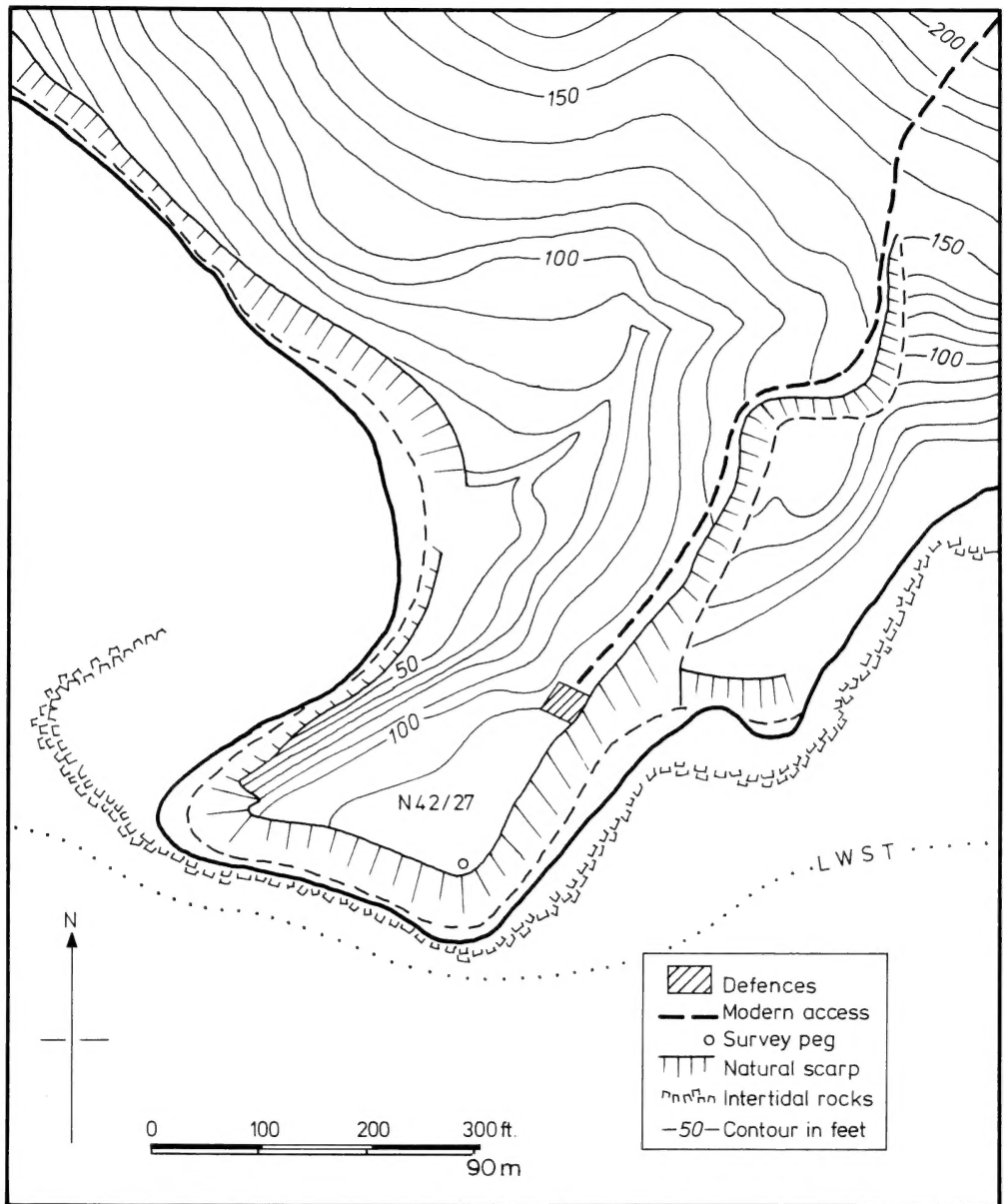


Fig. 2. Contour plan of the headland pa at Kauri Pt, Birkenhead and vicinity. Based on a plan provided by staff of the Auckland Harbour Board in 1971.

The most detailed account of Kauri Pt. is by Graham (1910). The pa which is the focal point of the story was named Te Matarae a Mana, and a footnote to Graham's account points out that "Kauri Point proper is not the bold headland with which that

name is usually associated, but the less majestic point next above it.” This could be interpreted in various ways. Simmons (1980) equates Te Matarae a Mana with N42/27. However, the name could also be taken to apply to a site, now damaged, of which traces remain in the vicinity of the Defence Department wharf near Onetaunga Bay, slightly further up the harbour.

Fenton (1879) mentions Onewa Pa as being “at Kauri Point” and the associated map shows Onewa as being on the west side of Kendall Bay and slightly inland — most probably on the high point now occupied by a water tower and the car park at the entry to the Defence Department land. This area has been extensively modified in recent times. Graham, however, consistently equates Onewa with Northcote Pt., a considerable distance further east.

The third pa was called Maunganui, described by Fenton as “inside Kauri Point” and by Graham as near the trig station on the ridge at the back of Kauri Pt. A few ambiguous remnants of earthworks near the trig may be all that remain of Maunganui.

Te Matarae a Mana (literally the brow or forehead of Mana) was the pa of Te Manaoterangi, a chief of the Kawerau people, who married a sister of Kiwi Tamaki, paramount chief of the Waiohau. Te Manaoterangi lived in the eighteenth century. Onewa was at one time occupied by Tarahawaiki, father of Apihai, one of the Ngati Whatua leaders in the nineteenth century.

On the traditional information that has been published, it is not possible to identify N42/27 with certainty as either of these pa. It may have been known by both these names at different times; it may have been neither. It is evident, however, that the general area of Kauri Pt. was of sufficient importance to both the Kawerau and the Ngati Whatua for them to occupy one or more pa there. Graham states that this part of the harbour was a very important fishing ground, particularly for sharks, and this is likely to have been a major factor in the occupation of N42/27, whatever its name.

BACKGROUND TO THE INVESTIGATION

The existence of the pa had been known for some time; it was among the first sites listed in the New Zealand Archaeological Association’s Auckland Site Record File. When the Birkenhead Borough produced its first revised District Scheme under the Town and Country Planning Act in 1969, no historic sites were listed and several objections were lodged on this point. Staff members of the Anthropology Department, University of Auckland, presented evidence at the hearings, in which they discussed the intact pa on the east side of Kendall Bay and the damaged one further to the west. They stressed the significance of the former, which they tentatively identified as Onewa.

As a result of the hearing, the Auckland Harbour Board, owners of the site, asked for an independent report on it from the Auckland Institute and Museum. The investigations in 1971 led to recognition of the site’s significance, and agreement that it should be preserved if possible. Neither the development of a deep water wharf at Kauri Pt., nor the construction of a second harbour crossing from Avondale to Kauri

Pt., which was under discussion in 1974, eventuated and the site was eventually listed as a place of historic interest in the Birkenhead District Scheme. The Harbour Board's decision that it no longer needed the Kauri Point Estate for harbour development land brought the area before the public eye again in 1984. The pa is now part of the Kauri Point Centennial Park, which consists of some 24 hectares purchased from the Harbour Board by the Birkenhead City Council in 1987, with assistance from the Queen Elizabeth II National Trust. Control is now vested in the new North Shore City Council and the Park is managed by a committee of interested citizens. The committee has undertaken the removal of inappropriate exotic plant species from the pa and is experimenting with revegetation using seed from native species collected from within the Park (K. Prickett pers. comm).

THE EXCAVATIONS

The investigations took place over six days at Easter 1971, under my direction, with the assistance of up to eight volunteers. The objective was to test the archaeological deposits to assess their complexity and the nature of the occupation. The defences and other visible surface features were mapped.

The site had been covered in thick gorse, privet and other introduced plants. Before the excavation began, Harbour Board staff had carefully cleared the vegetation by hand from the defences and the top flat part of the interior, although scrub remained on the western slopes.

The defensive earthworks, once cleared, are distinct and quite imposing. The interior, however, is relatively featureless, with no visible pits, and only slight indications of artificial levelling. The highest part is the relatively narrow strip adjacent to the cliff on the east side. The land slopes gradually and then more steeply away to the west. A low ridge in one part of the top flat area seemed to indicate levelling on either side, and some very slight scarps suggested minimal terracing on the western slope.

In view of the exploratory nature of the excavation, no attempt was made to investigate the defences. Four areas in the interior were tested, designated Areas A to D (Fig. 3). These four areas were related to a 49 m baseline extending from a peg above the defensive scarp to the southeast corner of the single square in Area D. Excavation was by hand trowel. Most of the deposits were not sieved, but a $\frac{3}{8}$ inch (10 mm) mesh sieve was used for some of the midden deposits in Area C.

Area A

Area A (Fig. 4) was on the most distinct of the low terraces on the cleared part of the western slope. The excavation here consisted of a 2 x 2 m square (Square 1) at the back of the terrace extending up the back scarp, and a 2 x 1 m half square (Square 2) towards the front of the terrace. This front edge was not bounded by a recognisable scarp; the ground simply began to slope away more steeply.

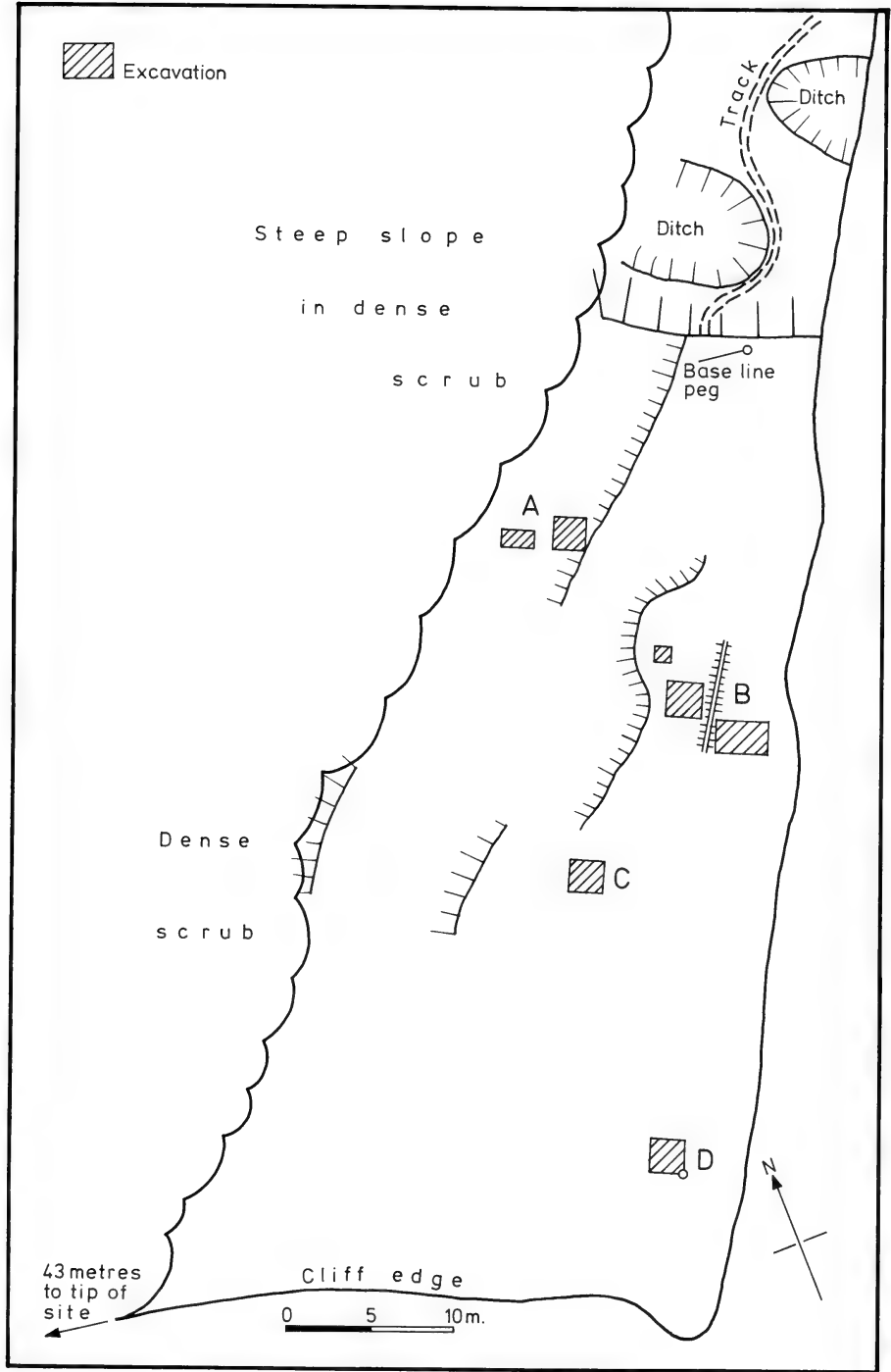


Fig. 3. Surface features and the positions of test excavations on the cleared part of the pa at Kauri Pt, Birkenhead in 1971.

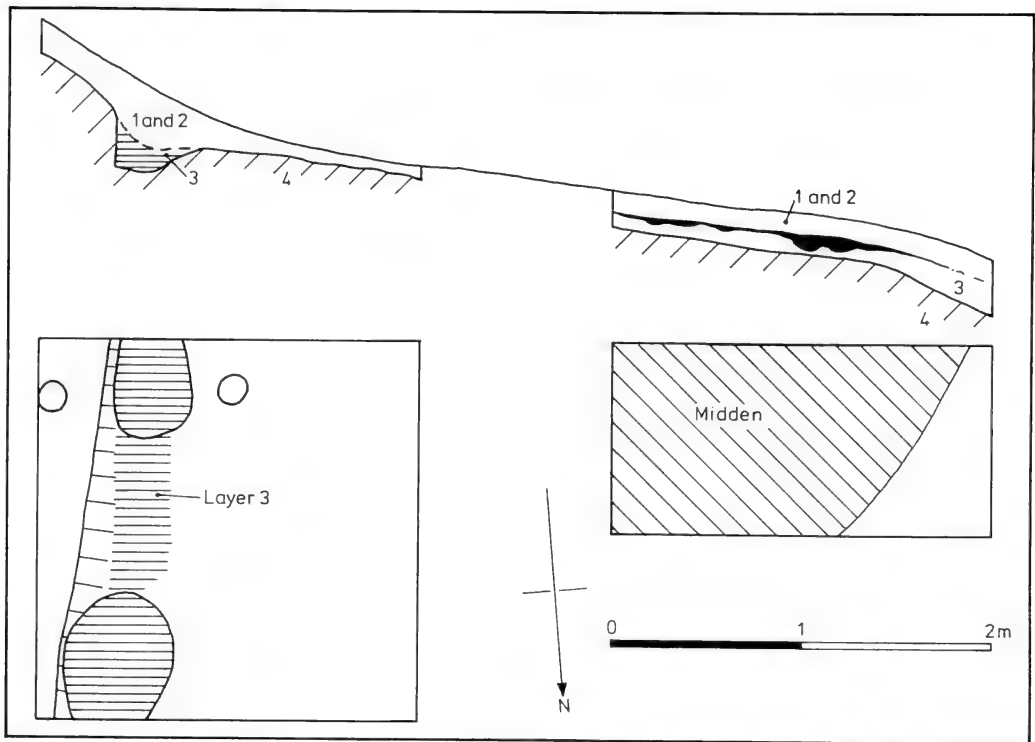


Fig. 4. Plan and cross-section of Area A, Kauri Pt, Birkenhead.

The stratigraphy was very simple. Layer 1 was the loose surface litter and Layer 2 was a grey-black topsoil with a patch of lighter grey sandy material in the northeast corner of Square 1. In much of Square 1, Layer 2 rested directly on Layer 4, undisturbed clay representing the weathered natural sandstone. Layer 3, present over most of Square 2 but restricted in Square 1, was a mixture of clay and soil with shell fragments and occasional stones. On the interface between Layers 2 and 3 in Square 2 was a greater concentration of shell fragments.

There were no features in the front of the terrace. In Square 1, however, there was a low but distinct artificial scarp at the rear of the terrace. At its base was a depression containing Layer 3, which deepened to more drain- or sump-like features also containing Layer 3 at either side of the square. Two postholes, one on the terrace and one on the scarp above, were the only other features. Both were about 20 cm deep and filled with Layer 2.

The midden was similar to midden elsewhere in the site and is discussed below. At the time of excavation, it was assumed to be a primary rubbish deposit. Shell layers have since been identified as deliberately laid flooring in several other sites in the Auckland area (see, for example, Foster & Sewell 1989: 11) and this possibility has to be considered at Kauri Pt. However, the restricted distribution and content of midden deposits in this site still make primary midden the most likely interpretation.

The excavation demonstrated that in this area there was a deliberately constructed terrace with what was probably initially intended as a drain at its rear. The terrace was constructed by making a modest cut back into the natural clay. The purpose of the terrace was not clear from the small excavation. There was no sign of a dwelling, or of use of this part of the terrace for cooking.

Area B

Three squares were excavated in Area B. Square 1 was to the east of the low central ridge in this area. It was originally 2 x 2 m with a 2 x 1 m extension to the east. Squares 2 (2 x 2 m) and 3 (1 x 1 m) were to the west of the ridge.

Stratigraphy was similar to Area A. Layer 1 was the surface litter, Layer 2 topsoil, Layer 3 a mixture of soil and clay, and Layer 4 a harder clay surface. In Squares 2 and 3 and in the southeastern part of Square 1 this appeared to be a largely unmodified natural profile. There was some indication that the low central ridge was at least partly artificial — formed by cutting down slightly into the natural ground surface — but this was by no means as clear as the terrace construction in Area A. Cultural material, in the form of stone flakes and other pieces of stone, was concentrated at the interface of Layers 2 and 3, although it was generally not possible to identify a definite surface at this point. There was very little midden, tiny patches in Squares 1 and 2, and none in Square 3.

Very few features were present. A single shallow posthole was recorded in Square 2, and no features in Square 3. In Square 1, the surface was considerably disturbed by rootholes, some of which could be confused with post and stake holes. There were at least eight shallow postholes, forming no noticeable pattern. Along the northern edge of the square were three shallow scoop depressions, one of which contained traces of charcoal and ash. A cluster of burned stones, apparently hangi stones, was sitting on the scarp in the western part of the square, but no actual hangi pit was found within the excavation.

It can be tentatively concluded that Squares 2 and 3 were in an open unmodified part of the site. Square 1, on the other hand, did appear to be in an area that had been slightly and roughly levelled and on which there may have been a flimsy structure of some kind.

Area C

Area C was on sloping ground below the central ridge. Again the stratigraphy was very similar. Layer 3 in this area was a thin deposit of whole and fragmentary shell midden mixed with soil, and was similar to Layer 3 in Area A. It was present throughout the square except for a small part in the northeast. There was one definite posthole 35 cm deep in the southeast of the square, and several shallow irregular depressions which may have been root disturbances.

Area D

Area D was located in the highest part of the site, in what appeared likely to have been the tihi area. The underlying natural was very variable in this square, ranging from pale grey sandy material through yellower sand to yellow clay. An iron pan was present in places. A scatter of cultural material was found at the base of the topsoil, but there was no midden at all. Three postholes were identified.

Discussion

The excavation revealed only limited use of the site. Considerable effort would have been put into the construction of the defences, but this effort was not matched by structural activity in the interior. It seems unlikely that there have ever been storage pits on the site, which is not surprising considering the poor potential of the vicinity for gardening. The occupants appear to have contented themselves with slight terracing of the gentle slopes to provide flat surfaces for activities.

The site presents a marked contrast to many others that have been excavated in the Auckland area. It lacks both the numerous refilled pits and the thick deposits of midden and cooking debris that are characteristic of the volcanic cones and pa in more densely occupied locations, and also of some undefended settlements. In view of its apparently strategic location, this lack of evidence of prolonged or repeated occupation was surprising.

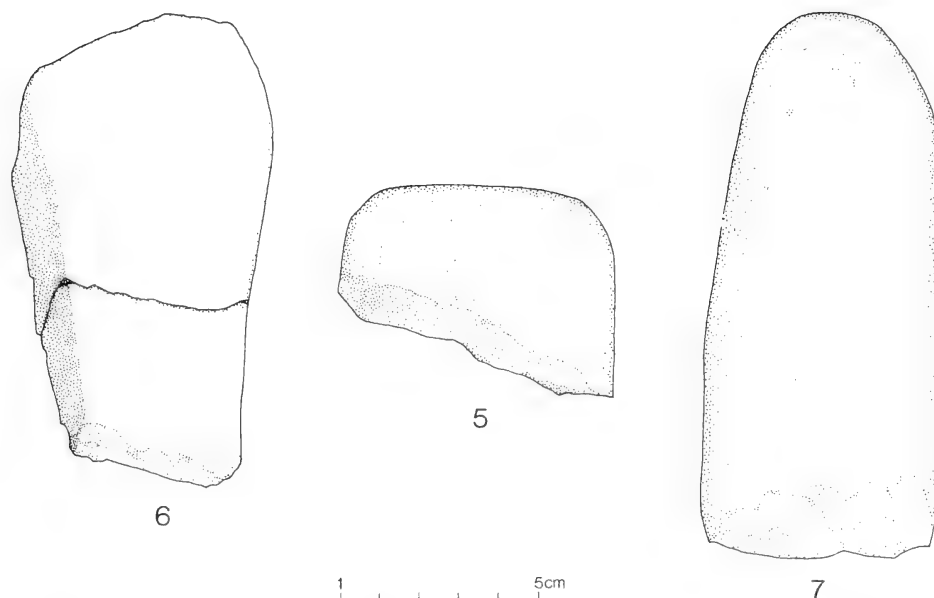
ARTEFACTS AND OTHER PORTABLE OBJECTS

Because so few pieces of stone or other artefacts were encountered in the excavations, both worked and unworked stone was retained. The stone assemblage excluding obsidian was studied by Prickett (1989) and her findings are summarised here. She has recently examined the obsidian and her description is included here as Appendix 1.

Finds from Area A included one piece of bottle glass from Layer 2 in Square 1 and a small collection of worked and unworked stone from Layers 2 and 3, mostly from Square 1. A battered, squarish cobble of basalt had subsequently been used as a hangi stone (Fig. 5) and a basalt pebble had been used as a hammer. There was a single piece of obsidian. Fourteen pieces of unworked stone included pieces of basalt, scoria, sandstone and greywacke, some of which had been used in hangi. There was one piece of kauri gum, apparently unused.

The largest assemblage came from Area B. Square 1 contained an 1897 penny, 2 small cartridge cases and 11 pieces of bottle glass, the latter mostly from the eastern side. This square also yielded the largest amount of prehistoric material, although Square 2 also produced a number of items.

A substantial part of a sandstone abrader was found in Square 1 (Fig. 6). It is in two pieces which join to form a used surface 12 cm long and 4-6 cm wide. The two long sides have also been used for grinding but the entire piece has broken off a larger



Figs. 5-7. Stone artefacts from Kauri Pt, Birkenhead. 5. Battered cobble, Area A. 6. Sandstone abrader, Area B. 7. Worked cobble, Area B.

block, so it is not known how thick the original object was, how wide the used sides were, and whether the fourth surface was also used. The complete surviving surface is slightly concave and could have been used for sharpening small adzes or chisels. Twelve pieces of sandstone which may be from one large shattered grindstone were found in the eastern part of Square 1. Four show signs of grinding. Three other pieces of grindstones were found in Area B. All these grindstone pieces are of local sandstone except one, which may be from South Auckland.

A heavy cylindrical basalt cobble (Fig. 7) from Square 2 has had flakes detached from one end, and the other end shows signs of hammering. It is not clear whether this was the beginning of an adze blank, or whether it had simply been used as a hammer and a source of flakes.

The worked stone from this area also includes 2 flakes of basalt, 3 flakes of andesite, 2 flakes of meta-argillite, 12 flakes of greywacke, a greywacke spall with a ground edge, and a large knapped piece of greywacke. The flakes vary considerably in size and include both "used" and waste flakes. Of 30 pieces of chert, only 2 have used edges, most show heat alteration, and 20 are probably from one shattered pebble. Eighteen pieces of obsidian include both used and unused flakes, as well as three tiny water worn pebbles, two of which are unmodified. Unworked stone from this area included pieces of basalt, scoria, meta-argillite and meta-greywacke, greywacke, sandstone, iron deposit, and mudstone. Some were heat shattered fragments, presumably derived from hangi stones. There was a single piece of kokowai.

Area C produced two basalt spalls with ground edges, three waste flakes of greywacke, and six waste flakes of chert. There were 7 heat shattered pieces of basalt, 26 pieces of scoria, all but one apparently hangi material, 2 fragments of sandstone, 1 heat shattered fragment of argillite and 1 piece of kokowai. A cartridge case was found on the surface of layer 3.

Area D produced a heavily corroded metal button about 14 mm in diameter, one piece of kauri gum, and two joining pieces of concretion which showed signs of battering and abrasion.

These finds suggest that Area B, on the central ridge, was a place where the inhabitants of the site gathered to work at artefact manufacture and repair. The grindstones and some of the other stone material seem to reflect men's activities, but Prickett suggests that some of the obsidian may have been used in flax or other fibre working. Area D, in the highest part of the site, was kept clear of both food and other debris. Whatever activities took place in Areas A and C, other than food dumping, relatively few traces of industrial activity were deposited there.

Prickett (1989) has discussed the sources of stone other than obsidian in some detail and drawn attention to the importance of the Albany Conglomerates as a source of stone for these people. The immediate vicinity of the site provided sandstone for abraders, but the basic need for hangi stones, as well as the need for raw materials for tools, had to be satisfied by imports. Some scoria and basalt from the Auckland Volcanic field was used for hangi stones, but basalt pebbles from the Albany Conglomerates seem to have been the preferred material. The nearest occurrence would be at Riverhead in the upper harbour. The Albany Conglomerates also provided material for flake tools. The Waiheke Group rocks were another important source of raw material including greywacke for flake tools and probably for adzes, and rather poor quality chert for cutting tools. A small amount of good quality chert was obtained from the Coromandel.

OBSIDIAN SOURCES

All nineteen pieces of obsidian from the excavations were analysed by the PIXE/PIGME accelerator technique at Lucas Heights, Australia. Absolute concentrations were calculated for 15 elements. The results for each artefact were compared with accumulated data from 18 sources of obsidian from New Zealand (Leach 1989). The sources are summarised in Appendix 1.

Seven pieces can be sourced with confidence to Mayor I. Four other pieces could be allocated with confidence to a single source area using the Popper's Razor algorithm (Leach & Manly 1982). Two are from Huruiki in Northland, one is from the Inland North Island sources, and one is from Fanal I.

The remaining eight pieces cannot be definitely sourced using this method. More than one source is statistically possible in seven cases. Four pieces are either from Huruiki or Great Barrier (Awana or Arid I); one could be from Huruiki, Hahei (Coromandel) or Arid I; one could be from Huruiki, Coromandel (Hahei or Cooks Bay) or Rotorua. The eighth piece could not be allocated to any known source in New

Zealand or the Pacific. Hand specimen examination of this piece confirms that it is obsidian and not bottle glass; its elemental composition is also inconsistent with artificial glass.

The 3 tiny pebbles were included among the 19 items analysed. Pebbles of this kind have been observed on Coromandel beaches and in the Waikato River catchment. They are probably common in all areas where detrital obsidian occurs, and would normally not be noticed. They have not previously been reported from archaeological sites, but they may have passed unnoticed in sites where stone material of all kinds is more abundant. The presence at Kauri Pt. of such pebbles from at least two different source areas may be a reflection of the difficulties experienced by Kauri Point people in obtaining obsidian and chert, and the fact that for them, any obsidian at all might be better than none. Alternatively, as Prickett suggests, they may have been obtained for a special purpose.

The full range of possible sources identified was represented by the ten pieces from Square 2 in Area B. The three pebbles, the unknown, and one of the Huruiki pieces were from this square. By contrast, there were three pieces from Mayor I and one from Huruiki from Square 1, one Mayor I piece from the eastern extension to Square 1, and two Mayor I and one Huruiki or Barrier from Square 3. The single piece from Area A was also Huruiki or Barrier.

There is a prevailing view (expressed recently by Ruddock 1988) that obsidian in the Auckland region came mostly from Mayor I or Great Barrier I. This view has partly developed as a result of earlier work on obsidian sourcing. However, Leach & Manly (1982) have shown that the earlier results are not particularly reliable. They have also demonstrated the need for extreme rigour in the statistical approach to source allocation; a plea which seems to have been ignored in some more recent work. The Kauri Point assemblage shows that these apparently hard pressed people were receiving very small amounts of obsidian from most, if not all, of the major source areas.

It is only rarely that a complete assemblage can be analysed in this way. It was possible in this case only because the assemblage was so small. The results, however, provide a cautionary tale against analysing a very small sample of "grey" pieces with the assumption that they are most likely to derive from a Great Barrier I source.

MIDDEN

The only deposits that were sieved were the Layer 3 midden in the south-west quadrant and the lower part of the Layer 3 midden in the south-east quadrant of Area C. Midden material was collected by hand during trowelling of the remaining deposits in Area C and throughout Areas A and B. No midden at all was found in Area D.

Bone

Bone fragments were extremely rare in the deposits.

A minimum number of two fish came from Area C: one snapper (*Chrysophrys auratus*) and one elasmobranch. The snapper was identified from two cranial bones and the elasmobranch from three small vertebrae. Eighteen unidentifiable fragments of fish bone were recovered from Area C and two from Area A. These few remains were in quite good condition, suggesting that poor preservation was not the reason for the paucity of bone recovered. It would appear that if the occupants of the site were there for fishing, as traditional accounts suggest, they were preserving their catch and taking it elsewhere, rather than consuming it on the site.

A piece of mammalian bone from Area A, Square 1, Layer 3, was identified as ilium fragment from the left pelvis of a dog. One other piece, not from the test excavations but from a midden exposure in the track down to Kendall Bay, is a cranial fragment which may also be dog, but could not be determined with certainty. The presence on the site of at least one dog is consistent with what is known from other sites in the Auckland area.

Shell

In the laboratory, the shells were sorted into species, and minimum numbers were calculated in the case of bivalves by counting valves with intact hinges and dividing by two, and in the case of gastropods by counting protoconches and opercula where present and taking the larger number. The results are given in Tables 1 and 2. It should be remembered that only the samples from the sieved deposits in Area C can be relied on as free from collector bias. There was undoubtedly more shell in Areas A and B than was retained, but the amounts were still very small.

The principal species were pipi (*Paphies australis*) and cockle (*Chione stutchburyi*) which were probably obtained locally, together with the mudsnails (*Amphibola crenata*). The few tuatua (*Paphies subtriangulata*) would have come from further afield. These shells were all quite well preserved. This was not true of the rocky shore species, which were recovered in more fragmentary condition, particularly the mussels and oysters, for which both species and minimum numbers were difficult to ascertain. The oysters were almost certainly all the northern rock oyster, *Crassostrea glomerata*, but the mussels may include species other than the northern blue mussel, *Perna canaliculus*. The relatively large number of slipper shells (Calyptraeidae) is unusual. They included both *Maoricrypta* and *Sigapatella* spp. These presumably reached the site accidentally, attached to larger and more edible shells. The other gastropods included *Diloma*, *Cominella*, *Thais* and *Haustrum* spp. representing both estuarine and rocky shore environments.

The small amount of midden is consistent with the lack of structural features and the small range of artefactual material recovered. The content of the midden suggests consumption of a small amount of shellfish and fish, largely gathered locally, during what appears to have been a brief occupation of the site. Despite the presence of quite a number of shells that would not have provided food, notably the slipper shells and some small spiral gastropods, the bulk of the shell fish remains do appear to be food debris, rather than deliberately laid flooring. The inedible species are most likely to have arrived at the site attached to the edible species, particularly the rock oysters.

Table 1. Minimum numbers of shellfish from Area C.

	1*	2	3	4	5	6	7
<i>Paphies australis</i>	11	213	32	188	58	1	503
<i>Chione stutchburyi</i>	22	284	38	276	181	4	805
<i>Amphibola crenata</i>	3	20	1	11	20	1	56
<i>Paphies subtriangulata</i>		3		4			7
Mytilidae		6		3			9
<i>Crassostrea glomerata</i>	3	15		20		4	42
<i>Turbo smaragdus</i>	3	49	3	86	20	3	164
Calyptraeidae		15	1	15	1		32
Other gastropods	2	7	1	9	5	1	25
Totals	44	612	76	612	285	14	1643

- | | |
|---------------------------------------|---------------------------------------|
| *1. Layer 2, whole square. | 2. Layer 3, southwest quadrant. |
| 3. Layer 3 upper, southeast quadrant. | 4. Layer 3 lower, southeast quadrant. |
| 5. Layer 3, north half. | 6. Posthole fill. |
| 7. Total. | |

Table 2. Minimum numbers of shellfish from Areas A and B.

	1*	2	3	4	5	6	7
<i>Paphies australis</i>	5		16	508	529	17	3
<i>Chione stutchburyi</i>			56	20	76		4
<i>Amphibola crenata</i>				6	6		
Mytilidae			1	4	5		
<i>Crassostrea glomerata</i>		1	10	13	24		3
<i>Turbo smaragdus</i>			8	12	20	1	
Calyptraeidae				5	5		
Other gastropods			1	1	2		1
Totals	5	1	92	569	667	18	11

- | | |
|--------------------------------|-------------------------------|
| *1. Area A, square 1, layer 2. | 2. Area A, square 1, layer 3. |
| 3. Area A, square 2, layer 2. | 4. Area A, square 2, layer 3. |
| 5. Area A, total. | 6. Area B, square 1. |
| 7. Area B, square 2. | |

CONCLUSIONS

The test excavations at this site have revealed a very different picture of Maori activity in Auckland from that obtained from excavations on and around the volcanic cones. Despite its position and natural defences, the pa appears to have been only briefly occupied by people who left few traces of their presence. More extensive excavations would probably reveal more structural features in the interior, but it is unlikely that a complex occupation history would be revealed anywhere on the site.

The use of the site does not seem to match the investment of labour that was needed to build the defences. The most likely explanation is that the pa was constructed by people who visited Kendall Bay for seasonal fishing, as traditions relate, but that most of their activities took place down in the bay. There are several possible reasons for the construction of such a pa. It may have been intended to proclaim the mana of the leader of the group; it may have been intended to assert the group's rights to the area; it may have been an insurance against surprise attack while the group were in residence at Kendall Bay. All of these factors may have contributed to a perceived need to build a pa at this location. However, the sparseness of its occupation history suggests that the sort of activities which took place in this part of the Waitemata throughout prehistory were of a kind not normally associated with pa building.

Acknowledgements. I am grateful to the staff of the Auckland Harbour Board who assisted with practical aspects of the investigations in 1971, and to those who took part. I am much indebted to Roger Bird of Lucas Heights for the PIXE/PIGME analysis of the obsidian, and to Foss Leach for interpretation of the results. I particularly wish to thank Kath Prickett for her work on the stone assemblage, and for her continuing interest in the site and its future. Fish bones were identified by Angela Boocock and mammalian bones by Ian Smith, both of the Anthropology Department, University of Otago. Illustrations were drawn by Martin Fisher, Jane Perry and Jadwiga Karas.

APPENDIX 1. OBSIDIAN ANALYSIS

K.E. Prickett

Number	Context (1)*	Source (2)	Colour (3)	Form (4)	Description
KPD	B/2/2	Mayor I	Green	F	Chunky flake. Three edges heavily worn: unifacial and bifacial edge damage. One edge ground.
KPK	B/3/2	Mayor I	Green (banding)	F	Thin flake with tip broken (for flax/fibre working?). One edge unifacially damaged.
KPM	B/3/2	Mayor I	Green (banding)	F	Well formed flake. Slight edge damage near point.
KPO	B/1/2	Mayor I	Green	F	Tiny thin waste flake.
KPQ	B/1/2	Mayor I	Green (weak banding)	F	Thin flake. Possible light unifacial edge damage.
KPR	B/1/2	Mayor I	Green	?F	Chunky piece with possible unifacial edge damage and broken point for fibre work?
KPS	B/1 (extn)	Mayor I	Green	F	Thin flake, slight unifacial edge damage. Good point for fibre work.
KPA	B/2/2	Huruiki or Gt Barrier	Grey (banding)	F	Long pointed flake, point end broken (deliberately removed?). Two edges with unifacial damage. Largest flake in the assemblage.
KPB	B/2/2	Unknown source	Grey/ brown	F (P)	Thick flake with thin edges. Struck from smoothly pitted pebble. Slight bifacial edge damage. Very translucent. Colour in transmitted light has a distinct brown tinge.
KPC	B/2/2	Gt Barrier or Huruiki	Grey (banded)	F	Thin flake. Unifacial damage on two edges.
KPE	B/2/2	Huruiki or Coromandel or Barrier	Grey (colour banded)	S	Possible slight unifacial edge damage.
KPF	B/2/2	Huruiki	Grey with green tinge (banded)	F	Very thin waste flake. Poor translucency.
KPG	B/2/2	Huruiki or Gt Barrier	Grey	S	Small angular piece. Slight unifacial edge damage on point.

Number	Context (1)*	Source (2)	Colour (3)	Form (4)	Description
KPH	B/2/2	Rotorua/ Taupo	Grey	P	Half a pebble. Pebble had a smooth water-rolled cortex before being halved. Point has small bifacially detached flakes.
KPI	B/2/2	Fanal I	Grey (with slight green tinge)	P	A halved, water-rolled pebble, but break is also water-rolled. No surfaces used.
KPJ	B/2/2	Huruiki, Coromandel or Rotorua/ Taupo	Grey (with brown tinge)	P	Small smooth water-rolled pebble, unmodified.
KPL	B/3/2/2	Huruiki or Gt Barrier	Grey	S	Small thin waste piece. Very good translucency. Two surfaces with semi smooth cortex (colluvial indicator?).
KPN	A/1/3	Huruiki or Gt Barrier	Grey (slight brown tinge)	S	Piece of snapped flake with sharp point suitable for flax or fibre work. Edge near point end has unifacial damage. Good translucency.
KPP	B/1/2	Huruiki	Grey (Grey/green in reflected light)	F	Decortication flake? Translucency poor. Rough cortex. Waste piece.

- * (1) Area/Square/Layer. (2) Leach 1989.
 (3) In transmitted light. 'Banding' refers to presence of flow bands.
 (4) F — flake. S — shatter (none of the characteristics of flake morphology present).
 P — pebble.

Discussion

The results of the obsidian analysis do not fit comfortably with the conclusion drawn from the remainder of the Kauri Point stone assemblage (Prickett 1989). There, the lack of variety of lithologies gave the impression of restricted access to raw materials as a result of political constraints at a presumed late date. Chert from the Coromandel Peninsula was the most distant rock type.

The obsidian results, however, indicate that this material was obtained from Huruiki in Northland, the Great Barrier I source area, Mayor I, and Rotorua/Taupo Volcanic Zone. The four major New Zealand source areas are all represented.

The obsidian pieces are all comparatively small, perhaps demonstrating that despite the variety of sources in circulation, quantity was limited. Another possibility is that this smallness simply reflects the work for which the obsidian was being used. If the area was hosting shark fishers in late summer to coincide with the shark breeding season, great quantities of harakeke (New Zealand flax) would be required to furnish and maintain fishing and processing equipment. Late summer is also the best time to process flax. The areas where the obsidian pieces were excavated may have been the work places of flax weavers. A number of the pieces have points removed (deliberately) and edges suitable for fibre work (Dante Bonica, pers. comm.).

A variety of obsidian source types is apparent from the cortex present. This ranges from completely smooth water-rolled surfaces through moderately smooth surfaces to a rough striated cortex. Thus fluvial, colluvial and an *in situ* source are evident.

What is something of a surprise is the differing source areas assigned to each of the pebbles by the PIXE-PIGME analysis. If indeed three separate sources are involved, it hardly seems reasonable to explain the presence of the pebbles in close proximity at Kauri Pt. as a fortuitous event. This unusual group of pebbles may represent pieces for a game or ritual.

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THE ARTEFACT COLLECTION FROM WHITIPIRORUA (T12/16), COROMANDEL PENINSULA

LOUISE FUREY

AUCKLAND

Abstract. The early or 'Archaic' beach midden at Whitihipirorua, or Onemana, has produced a large and varied collection of artefacts now housed in the Auckland Museum.

The artefacts are typical of those found in similar sites along the eastern coast of the Coromandel Peninsula. Decorative pendants, fishing gear, adzes and a wide range of manufacturing tools such as drillpoints, sandstone files, hoanga, hammerstones and flake tools are described.

The stone artefacts show a heavy reliance on locally obtained resources and a predominance of Tahanga basalt for adze making.

Radiocarbon dates from recent excavations on the site indicate the artefacts predate the 15th century.

In the Auckland Museum there is a large collection of artefactual material, and archaeological samples, from the early Maori site of Whitihipirorua, situated on the beach dune at Onemana on the Coromandel Peninsula (Fig. 1). The site is also known as T12/16 (N49/16) in the N.Z. Archaeological Association's site file system.

The majority of the artefacts were collected by R.G.W. (Bob) Jolly, assisted by other persons including Eleanor Crosby, Jim Donald, Beryl Jolly, Kim Jolly, Don Melrose, Pat Murdock, Tony Parsons, Hugh Simpson and David Trower. Although Jolly's attention was first drawn to the site in 1956, the bulk of the artefacts and samples were recovered between 1962 and 1973 when more than 44 separate visits were made to the site. In more recent years surface finds by John Coster, Sheridan Easdale, Louise Furey, Chris Jacomb, Gabrielle Johnston, Garry Law, Phil Moore, Annetta Sutton and Michael Taylor have added to the site's extensive assemblage. In addition, a few artefacts were recovered in small scale excavations carried out by the author in 1986 and 1988. Some of these artefacts are also described.

Jolly's activities on the site were a combination of excavation and surface collection. Artefacts and samples recovered were bagged according to date, and in some cases by square and layer. The most consistently provided information was the date of collection and the collectors' names. The material excavated had been sieved in most cases and sorted into identifiable artefacts, bone, various types of stone material, shell (if retained), pumice and other miscellaneous material such as charcoal and wood.

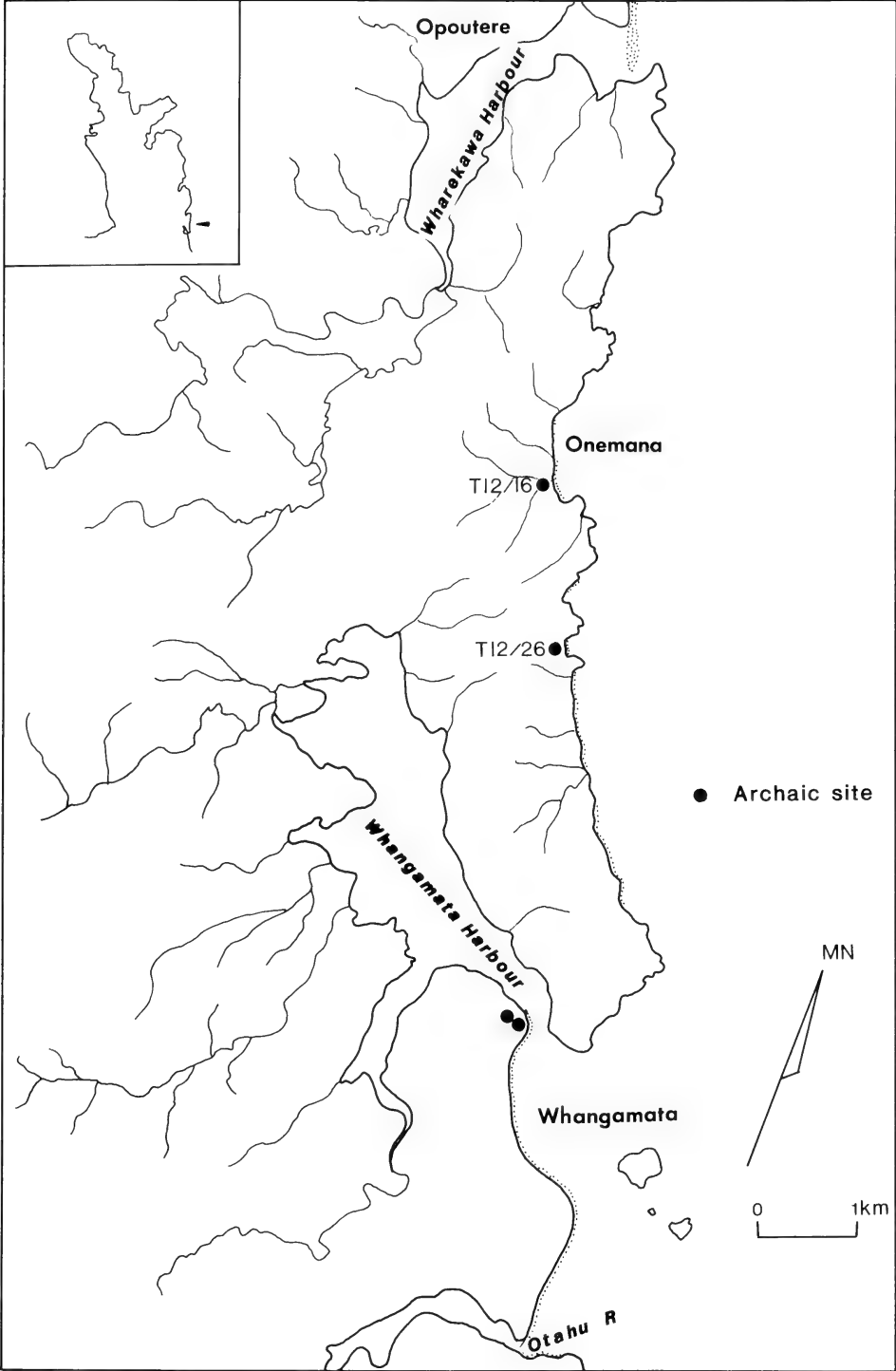


Fig. 1. Locality map.

Jolly's excavations over several years concentrated on two areas called the 'Main Hook Floor' or 'Site 1', and 'Mollie's Site' also known as 'Site 2', approximately 7 metres to the north near the stream (Fig. 2). Jolly (1978a:130) identified these areas as having a concentration of fishhook manufacturing material, estimating they were 12 x 12 m and 7 x 6 m respectively in size. Other locality descriptions are 'Minefy's', 'Eggshell Excavation', 'Upper Hook Site' and 'Top Site'. A number of individual squares were excavated intermittently over a considerable time period within each of these areas. In addition, artefacts were surface collected over the entire site as erosion exposed cultural material.

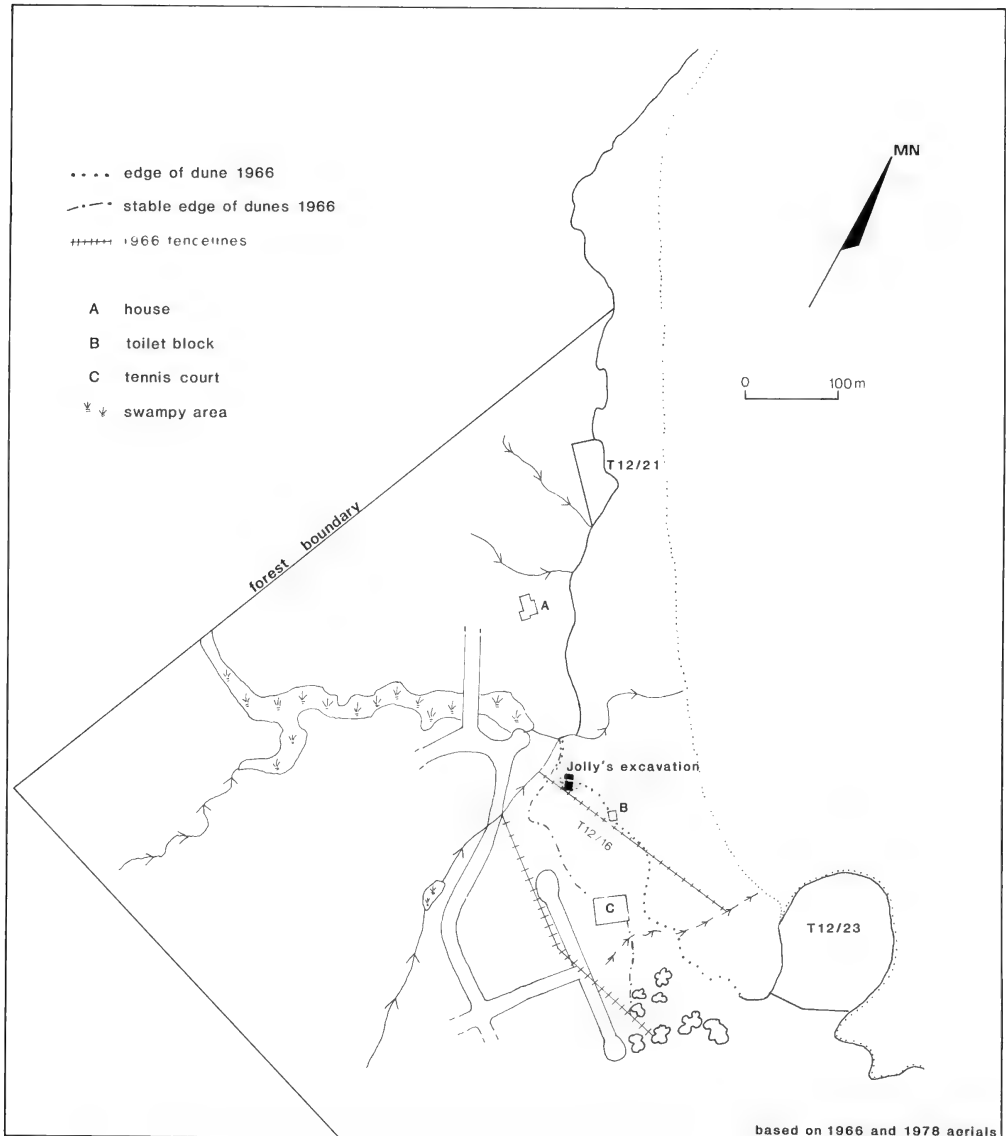


Fig. 2. Whitipirorua site, Onemana, showing location of Jolly's excavations.

Records and stratigraphic details relating to the sub-surface work carried out by Jolly are scarce. A brief article was published (Jolly 1978a) and general notes and a sketch of the site are in the files of the Museum's archaeology department. A map showing exposed concentrations of surface material was made by Mollie Nicholls (now Hougaard) in 1964 and published in the same article. Further information was obtained from the captions on the sample bags and artefacts. These were occasionally accompanied by a sketch map.

From the available information it can be reconstructed that there were two main cultural layers — an upper shell midden and a lower layer of mussel shells, separated by sterile sand. Jolly (1978a:130) described the stratigraphy as follows: “the main cultural layer is beneath sand with ordinary shell midden above. In some places the layer is about 30 cm thick, in others about 1 m. Mussels must have been easily obtained by the first comers as many shells rest close to the natural sand.” Several sketch diagrams accompanying samples indicate a black sandy layer above the mussel shell layer in ‘Mollie’s Site’, and many of the artefacts were recovered from the interface of the black layer and the sterile sand above (M. Hougaard, pers. comm.).

In 1974, during construction of the residential subdivision of Onemana, sand quarrying and general recontouring of the dune area destroyed the northern part of the site including the area investigated by Jolly.

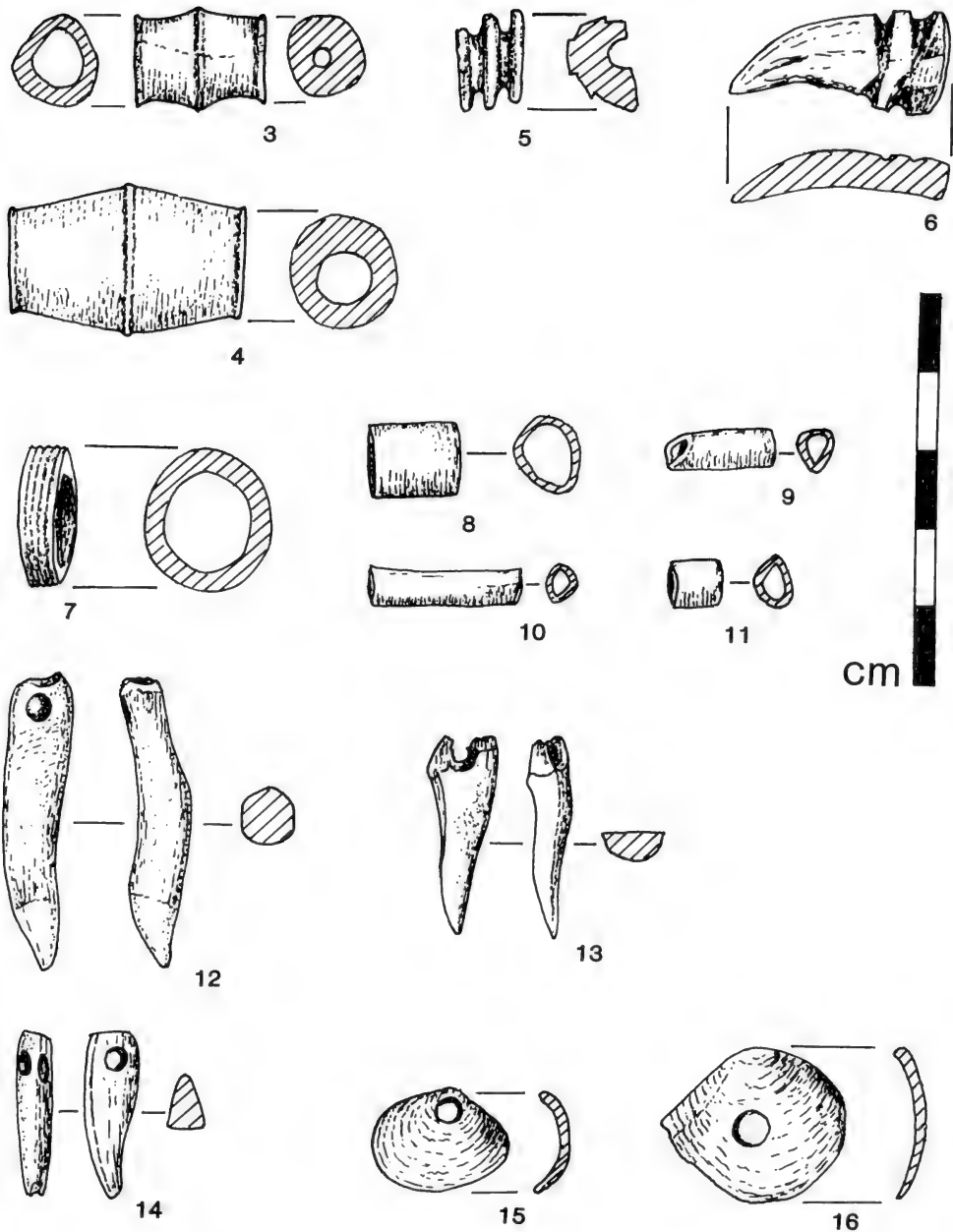
Because of the lack of consistent and reliable layer information, the collection has been described collectively as an Archaic assemblage without reference to area location or possible relationships within or between layers.

Catalogue numbers

Artefacts and samples have catalogue numbers prefixed with either an AR or AU. This refers to the repository when the items were first accessioned. AR is the prefix denoting the archaeology collection in the Auckland Museum. AU indicates the Anthropology Department of Auckland University where some of the collection was initially placed prior to an archaeology department being set up at the Museum. All material with an AU number is now permanently located in the Auckland Museum. There are also several items with no alphabetic notation which are part of the general ethnology collection in the Auckland Museum. A few items, which were still in the possession of the late Mr Jolly when this paper was being researched, are identified jointly by the catalogue number relating to the Jolly collection and the more recently acquired Auckland Museum AR number.

ORNAMENTS

A variety of ornaments in bone, ivory and shell have been recovered from the site (Figs. 3-16). Similar pieces have been recovered from other early sites. Several of the pendant styles have their origin in East Polynesian material culture (Davidson 1984:77-81).



Figs. 3-16. Ornaments, Whitipirorua site. 3-5. Reel necklace units. 3. AR5472. 4. AR4408. 5. AR4683. Reel preform. 6. AU1525/1. Dentalium shell unit. 7. AR310. 8-11. Bird bone tubes. 8. AR4633. 9. AU1522/2. 10. AR5470. 11. AU1522/3. 12-14. Pendant units. 12. AR176. 13. AU1593/2. 14. AR2238. Perforated shells. 15. AR6338. 16. AR4631.

Reels

Three reel necklace units, of varying sizes, are in the collection. AR5472 (Fig. 3) appears to have been manufactured from a section of bird limb bone and is a good example of a reel with three transverse ridges. A larger reel, AR4408 (Fig. 4) is very similar and made of ivory. The central longitudinal hole has been drilled from both ends. AR4683 (Fig. 5) is a different type of reel with the three transverse ridges in sharper relief than in the other two examples. The reel is broken longitudinally.

An artefact in the process of manufacture, AU1525/1 (Fig. 6) was possibly intended to be a reel similar in shape and size to that shown in Fig. 5. The eye tooth of a sea mammal has two grooves at the root end. The tooth enamel has been partially ground off and the surface faceted at the upper end. The tooth has longitudinally split in half. In the case of small reels it is likely the reels were manufactured on a longer segment of raw material and the surplus sawn off later. A similar technique is described in Duff (1977:93).

Bone tubes

Eleven cut bone tubes, varying in length from 6.6 to 18.5 mm, indicate another common ornament type of the early period. A selection of sizes are shown in Figs. 8-11. All have parallel transverse end cuts with the exception of AU1522/2 (Fig. 9) which has an angled cut at one end. One very small cut tube has an outer diameter of 2.9 mm and is of a similar size to the *Dentalium nanum* tube segments.

Dentalium rings

Eleven rings cut from fossil *Dentalium* shell are listed in the catalogues. Only eight were located. Narrow transverse grooves, varying between two and four in number, have been scored around the circumference of each ring. The natural longitudinal ridging pattern on the shell appears as shallow notching on the surface of the rings, adding to the decorative effect. In the case of AU1101 four rings are of decreasing size, suggesting they were cut from one *Dentalium* tube.

AR310 (Fig. 7) was excavated by Jolly from 'Mollie's Site' while the remaining rings (AU1101) were found together on the surface at the southern end of the site in the vicinity of a burial. However it is not known if there was a direct association.

Dentalium nanum was also found in the site although not in large quantities.

Leach (1977:476) tentatively identified the fossil shell as *Dentalium solidum*, found in fossiliferous Miocene mudstones. Although these mudstones occur in a number of places throughout New Zealand, the quality of the *Dentalium* shells, and suitability for use in artefacts, varies considerably.

Dentalium nanum has been reported from a number of Coromandel sites, but the larger *Dentalium* shell is known only from Hot Water Beach where the shell had been worked to duplicate a bone reel with three transverse ridges (Leahy 1974:40,42).

Pendants

Two perforated teeth and a shaped bone artefact were probably intended to be worn individually as ear pendants, or collectively with a number of similar objects as necklaces.

The tooth of a sea mammal (AR176, Fig. 12) has a hole drilled through one side at the root end. The attachment cord presumably passed through the hole and out through the hollow tooth cavity.

A tooth from a mako shark (*Isurus oxyrinchus*) (AU1593/2, Fig. 13) had a hole drilled at the upper end although this is now broken.

A small shaped bone pendant, AR2238, has one side flattened and an outward curve at the lower end (Fig. 14). The perforation is bi-laterally drilled. This artefact is similar in shape to the imitation whale tooth pendant unit, a popular style in the early period which continued to be made through time in more generalised shapes (Furey 1986). This particular example, with a length of 23 mm, is considerably smaller than other similar units held in museum collections and illustrated in Duff (1977:112-119) and Davidson (1984:80).

Perforated shells

Four perforated marine bivalve shells from two species may have been necklace or ear pendants. AR6338 (Fig. 15) comprises two shells of a *Tawera* sp. Although of the same size, they appear to be from different shellfish. Both AR4631 (Fig. 16) and AR547 are of a *Myadora* sp. These are however of different sizes.

Similarly drilled shells have been found in other Coromandel Archaic sites, and a necklace of drilled *Myadora* shells was recovered from Wairau Bar.

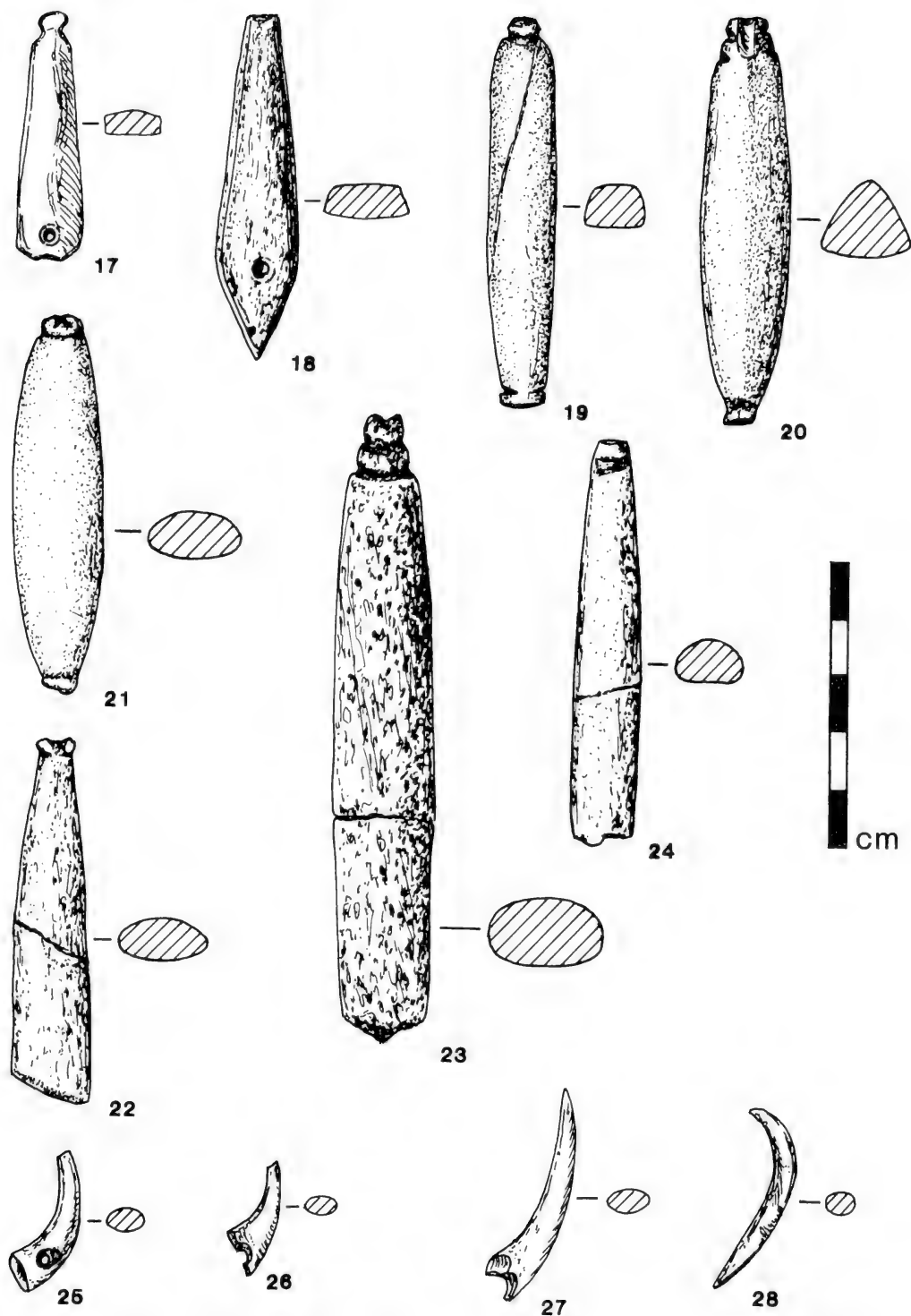
FISHING GEAR

A full range of fishing gear from trolling hooks and lures to one- and two-piece hooks in bone and shell are represented.

Trolling lure shanks

Eight complete or near complete lure shanks have been made from either stone, bone or shell (Figs. 17-24). Several different forms of line and point lashing are apparent. All can be assigned to the early grooved shank series defined by Crosby (1966).

AR5469 (Fig. 17), fashioned from the shell of a marine bivalve, has a dorso-ventral hole for line lashing and reduces in width towards the point attachment end. A notch on either side facilitates lashing of the point as does a notch on the end. Davidson (1979:195) likens the shield shape of this lure to examples from Murihiku. Shell lures are relatively uncommon on the Coromandel Peninsula and this is a particularly well preserved item.



Figs. 17-28. Trolling fishing gear, Whitipirorua site. 17-24. Trolling lures. 17. AR5469. 18. AU1593/1. 19. 46450. 20. AR46451. 21. AR46452. 22. AR46454. 23. AR46453. 24. AR46455. 25-27. Trolling hook points. 25. AR5461. 26. AR4444. 27. AR7493. Barracouta hook point. 28. AR5462.

Another lure shank, AU1593/1 (Fig. 18), also with a dorso-ventral hole, has a pointed head with a circular groove on the nose. The end is squared. The stone material is schist, the source of which would have been in the South Island (K. Prickett, pers. comm.). Both AU1593/1 and AR5469 have a flattish cross-section and are similar to the Tairua pearl-shell lure interpreted as an early lure shank form (Green 1967:84) with parallels in East Polynesia.

The remaining lures have grooves or notches for line attachment. 46450 (Fig. 19), made from mudstone, has a circular groove for line lashing and side notching for point attachment. The lure is rounded rectangular in cross-section with a flattened back.

The remaining lures all have a levelled platform for hook seating although the lashing form varies. Side notching occurs on 46451-4 (Figs. 20-23), while 46455 (Fig. 24) has a ventral slot. On 46452 notches on the ventral side form a V. Cross-sections represented are oval, rounded triangular and rounded with a flattened dorsal surface. 46451 and 46452 are made from limestone, while the remainder are of bone. 46453 is whale bone and is the largest lure with an incomplete length of 110.2 mm (the head is missing).

Stone lure shanks are rare in Coromandel Archaic sites as are shanks of triangular cross-section (Davidson 1979:195). The lure made from schist is particularly important as the stone shanks present in Coromandel sites tend to be made of locally available materials.

Lure hook points

Two of the three lure hook points, all made of bone, are similar. Both are uni-perforate points with no projections. This is the most common type of lure point to be found on the Coromandel Peninsula and is the only type represented in excavated site assemblages. However a bi-perforate example is known to have been surface collected at Port Jackson (Foster 1983:58,62-63).

AR5461 (Fig. 25) and AR4444 (Fig. 26) are examples of the uni-perforate lure hook point. AR5461 has a slightly concave base and an intact lashing perforation. AR4444 is similar but is a smaller hook.

AR7493 (Fig. 27) cannot definitely be categorised as a lure hook point but the lashing perforation and angle of the hook does suggest that was its use.

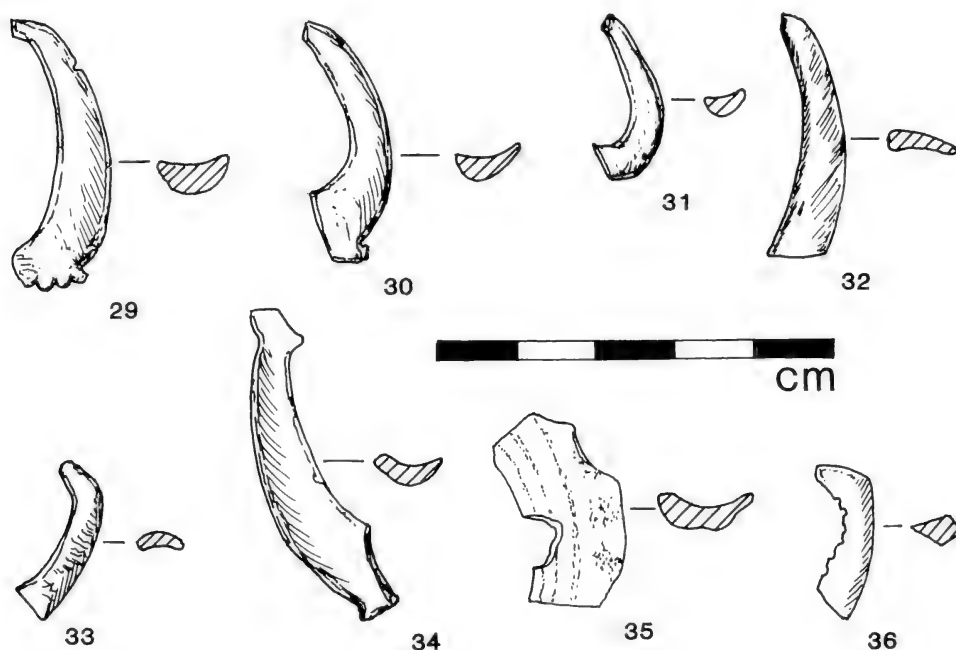
Barracouta hook point

A bone point (AR5462, Fig. 28), reminiscent of a barracouta hook point, is round in cross-section and has an indentation at the mid-point on the outer curve. The point does however have a greater curve than is apparent in many other barracouta hooks. Crosby (1966:150) suggested that the curved points associated with barracouta trolling gear were a late introduction from the South Island, but this is in no way substantiated, and the presence of this artefact in the collection does tend to negate the argument.

Shell fishhooks

Shell fishhooks are not common on early Coromandel sites, previously being known only from Cross Creek (Sewell 1988), Wheritoa (Crosby 1977:27,28), Hot Water Beach (Leahy 1974:37) and the Opito sites of N40/16 (Law 1984) and N40/2 (Murdock & Jolly 1967, Jolly & Murdock 1973).

Complete one-piece shell hooks are absent from this collection but several examples of two-piece hook points and one shank, all made from *Cookia sulcata*, are present (Figs. 29-34).



Figs. 29-36. Shell two-piece fishhooks, Whitipirorua site. 29-33. Shell points. 29. AR5474. 30. AR5478. 31. AR5478. 32. AR4407. 33. AR5463. Shell shank. 34. AR5478. Shell hook blanks. 35. AR7720/1. 36. AR5463.

The points are most easily described according to the form of the attachment base where point and shank were joined together with cord. Four lapped bases, with the number of notches ranging from three to five, are present although only two of these are complete with the point tip attached. AR5474 (Fig. 29) is the largest example. Three points with a base for butting against the shank are also present. Again AR5478 (Fig. 30) is the largest.

AR5478 (Fig. 31) is unusual in that it does not have a notch or projection on the outside of the curve but is in all other respects similar to the points with a lapped attachment. The curve is flattened at the place where the notch would have been but there is no clear evidence it has been broken off, nor that it has been repaired.

In addition three straight points, for example AR4407 (Fig. 32), have no means of attachment and may have fitted into a slotted shank as discussed by Law (1984:8).

AR5463 (Fig. 33) is an anomaly in that it has an incurved point with no reduction in width at the point end, and also no evidence of attachment. It is possible that this is part of a one-piece hook.

One complete shank (AR5478, Fig. 34), also with a butted base, indicates that in this site shell shanks were utilised but the general absence of shell shanks from sites containing shell points led Law (1984:5) to suggest wood may have been a more commonly used material.

Manufacture of shell fishhooks is indicated by three tabs of *Cookia sulcata* of which AR7720/1 (Fig. 35) is an example. It is suggested from the shape of the tabs that two-piece hooks are being made. In addition a hook fragment, AR5463, in the next stage of manufacture with drilling scars on the inner curve is illustrated in Fig. 36.

One-piece fishhooks

The Coromandel Archaic sites have produced large numbers of one-piece fishhooks, and Whitipirorua is no exception. Although nearly all the hooks are broken, parts of at least 51 individual hooks are present when point limbs and shank limbs are totalled. Broken fragments of bend also occur. In addition, over 220 tabs have been recovered. The hooks are made from a variety of materials. Bone hooks are the most common with moa, whale and sea mammal represented. Ivory and shell were also used.

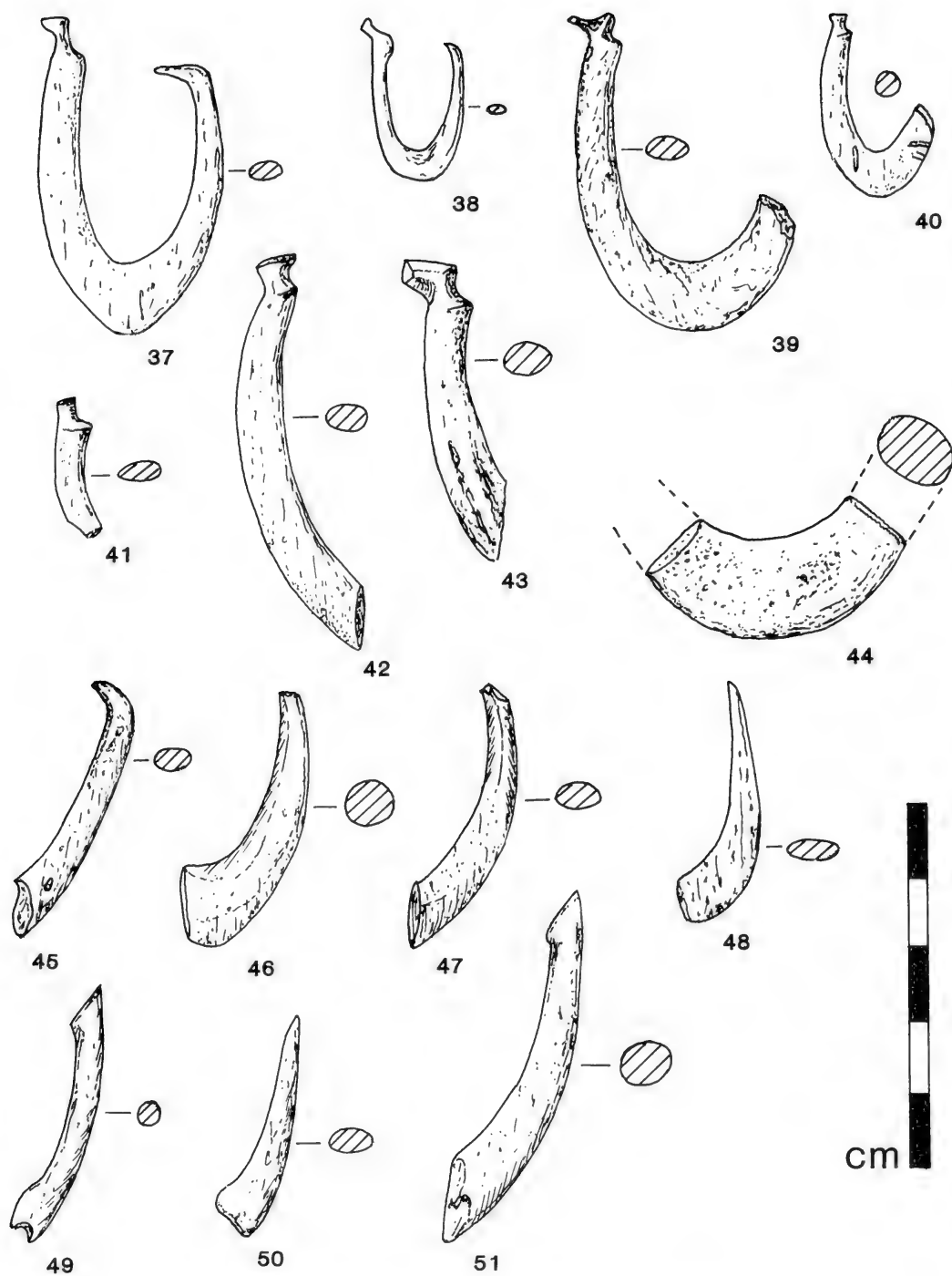
The hooks most commonly fit into the type called Opito I, defined as an oval one-piece hook with an incurved point (Crosby 1966:187-188).

Two complete hooks (Figs. 37,38) illustrate the basic Opito Type I, and the size range available. Jolly Coll. 83 (AR7947, Fig. 37), fashioned from moa bone was found in the lowest level of the Upper Hook Site associated with a layer of mussel shells. Jolly Coll. 84 (AR7948, Fig. 38) is an ivory hook.

The hooks from the site are generally in the small to medium size range and this is reinforced by measurements of discarded tabs (Fig. 74). One exception is the bend of a whalebone hook (AR5466, Fig. 44) which must have been of a large size.

The remaining hooks have generally been broken across the grain at the base or lower part of either the point or shank limb near the bend.

Several forms of head occur. The most common is illustrated by AR4612 (Fig. 42), where scarfs have been cut to facilitate lashing. A variant of this is shown in AR7477/1 (Fig. 39) where an additional scarf creates a notch in the top of the head. Another type, with an extended head (AR227), is shown in Fig. 43. This form is uncommon on Coromandel sites and is represented in the collection by a single specimen. AR4839 and AR4634 (Figs. 40,41) illustrate another head form which has no knob. This type does occur in other sites in conjunction with the more common knobbed variety.



Figs. 37-51. Fishing gear, Whitipirorua site. 37-48. One-piece fishhooks. 37. AR7947. 38. AR7948. 39. AR7477/1. 40. AR4839. 41. AR4634. 42. AR4612. 43. AR227. 44. AR5466. 45. AU1296. 46. AR342. 47. AR173. 48. AR7736. 49-51. Two-piece hook points. 49. AR4815. 50. AR4970. 51. AR4815.

While the majority of fishhooks, for example AU1296 (Fig. 45), have an incurved point typical of the Opito Type I hook, straight points which Crosby (1966:201) called Opito Type II, and interpreted as a reworked Opito I, are also present (AR342, AR173, AR7736, Figs 46-48). It is by no means certain that the differences are so easily explained as the function of the hook is changed from a rotating to a jabbing hook.

Bait notches are not common but do occur. AR4839 (Fig. 40) has a shallow groove on the point limb.

Two-piece bone hooks

The identification of some two-piece hook points is problematical in that lashing or drill holes at the base may be equally due to repairs carried out on broken one-piece hooks or to deliberate two-piece manufacture.

Two, both AR4815 (Figs. 49,51), with a straight jag tip differ from any of the one-piece hooks and are therefore more likely to be two-piece hook points. Both have evidence of broken out drill holes at the base of the shank to indicate where the point was lashed to the other part of the hook. This is an unusual lashing form, the more common type being outer notches. An alternative, and equally likely, interpretation of these points is that they are trolling lure hooks. Leach (1979:101) observed that "certain identification of lure points is difficult since they are basically the same shape as those for two-piece hooks", while Crosby (1966:148-149) associates the jag tip form of drilled lashing point with the early grooved shank series of kahawai lure, several of which were found in the Whitipirorua site.

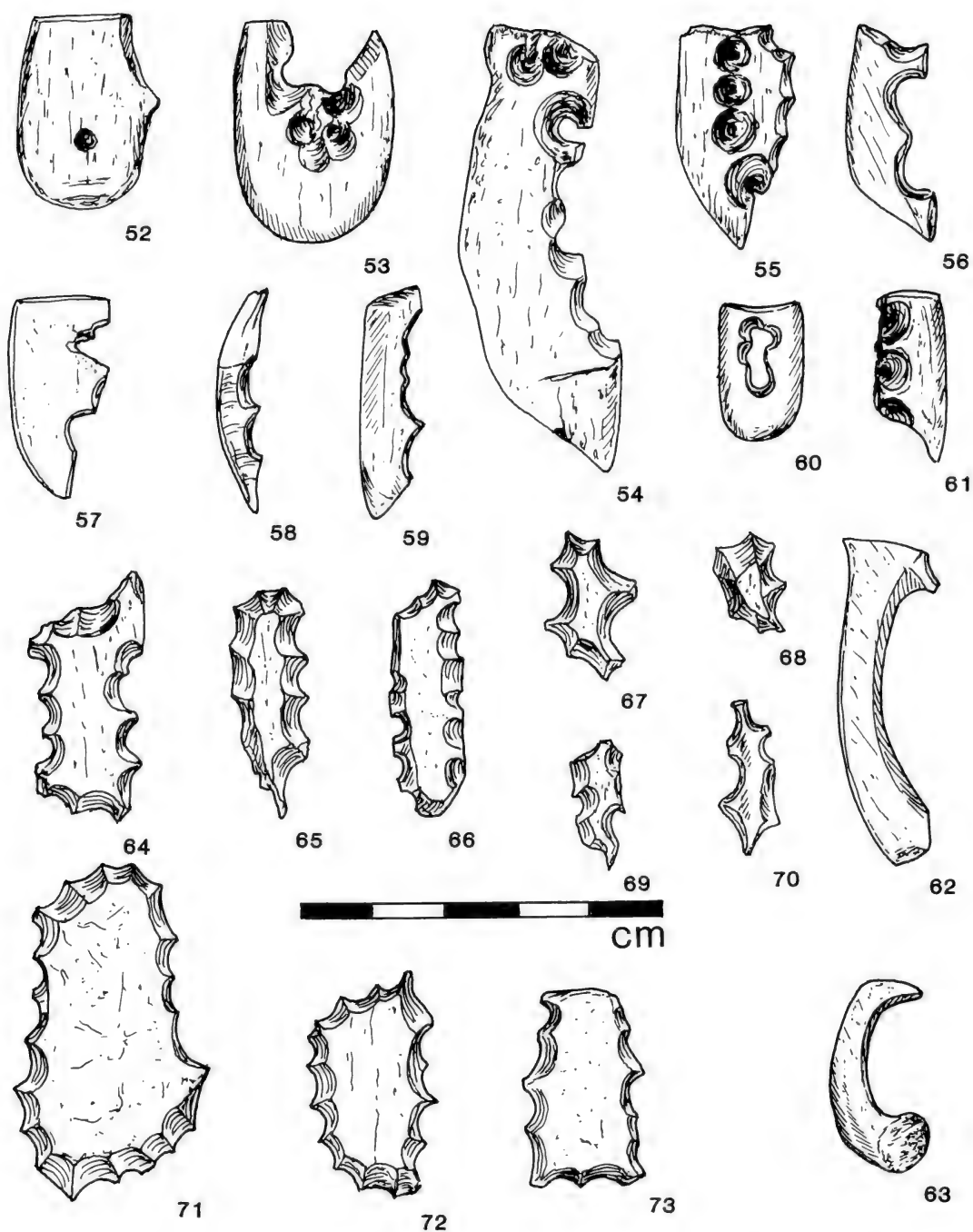
AR4970 (Fig. 50) has a straight point similar to the Opito II variety of one-piece hook but has evidence of a drill hole at the base. This particular point may be either a two-piece or part of a repaired one-piece hook.

Manufacture of hooks

There is a considerable amount of evidence for one-piece fishhook manufacture on-site. The various stages of manufacture, from prepared pieces of bone through to shaped but not completed fishhook pieces, are shown in Figs. 52-63, along with a selection of tabs (Figs. 64-73) drilled from the centres of the hooks.

The manufacturing debris shows a greater range of raw material than is evident in the finished hooks. Bone, ivory (Figs. 57,60,61), and shell (Fig. 59) were used. AR4611 (Fig. 54) is a fragment of mammal jaw. AR4882 (Fig. 58), a tooth, is most likely intended as part of a composite hook. The smallest hooks appear to have been made from ivory. This is apparent from the finished hooks and the tabs. Shell and ivory tabs also tended to be thinner than their bone counterparts, perhaps reflecting greater strength in the material being used.

A plot (Fig. 74) of the size of tabs reinforces the evidence from the finished artefacts that the hooks fall into the small to medium size range, with only a few being very large.



Figs. 52-73. Fishhook manufacturing debris, Whitipirorua site. 52. AR314. 53. AR172. 54. AR4611. 55. AR4635. 56. AR4744. 57. AU1525/4. 58. AR4882. 59. AR4611. 60. AU1721. 61. AR5476. 62. AR4709. 63. AU1525/3. 64. AR313. 65. AR2238. 66. AR260. 67. AR4744. 68. AR4744. 69. AR4722. 70. AR4456. 71. AR4444. 72. AR4744. 73. AR4635.

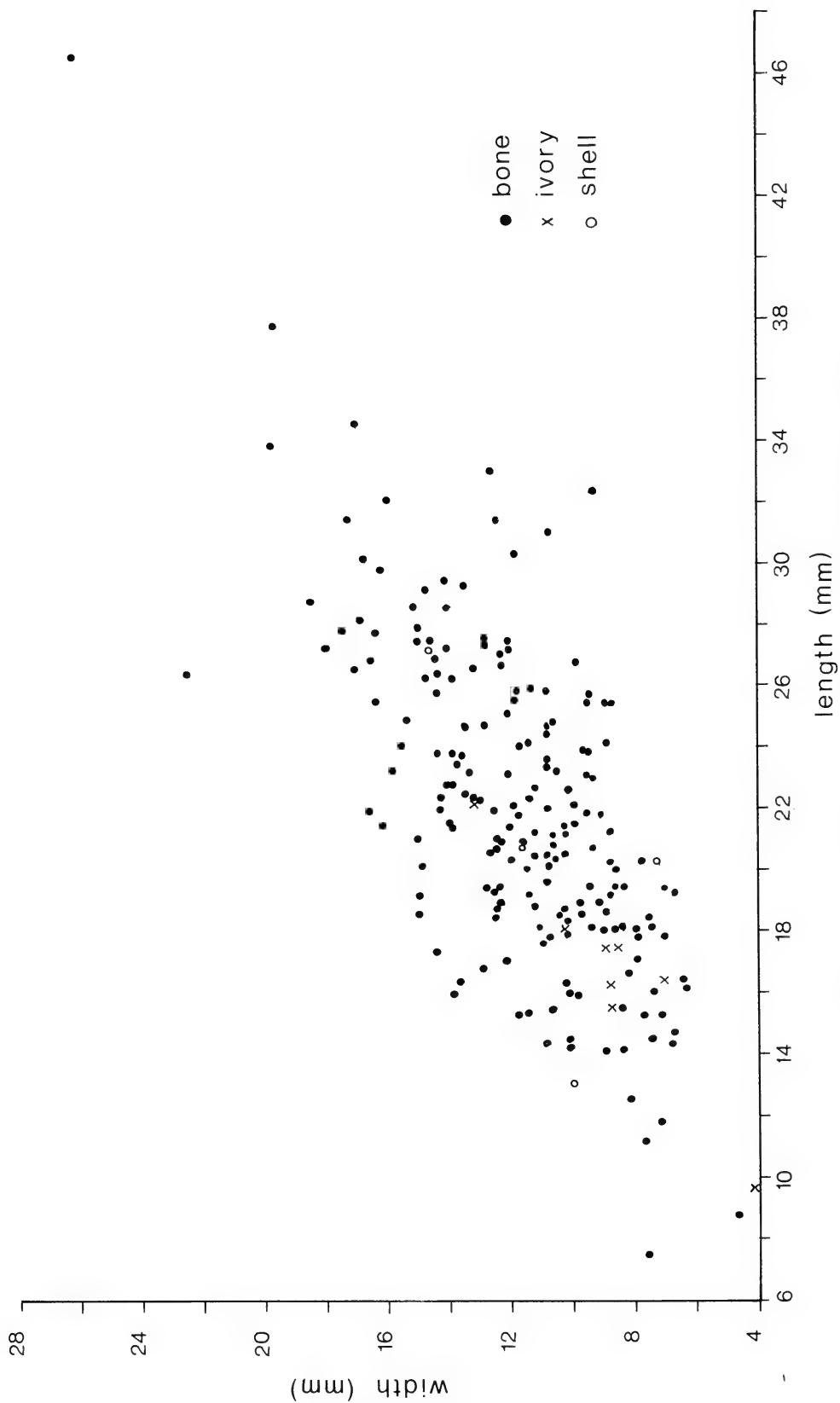


Fig. 74. Size distribution of one-piece fishhook cores, Whitipirorua site.

The size distribution of cores is similar to the situation at Hot Water Beach where it was found cores exceeding 30 mm in length could be considered large for the site, and cores under 15 mm were small (Leahy 1974:36). The median length of the tabs is also similar at both sites, with 21.4 mm at Whitipirorua and 22 mm at Hot Water Beach. At the Opito Beach Midden, N40/3, Boileau (1980:70) concluded from the size of the cores that larger hooks were being used.

MISCELLANEOUS ARTEFACTS

A selection of other bone and shell artefacts are shown in Figs. 75-83.

Tattooing chisel

AR5475, a tattooing chisel (Fig. 75) has not been firmly provenanced to Whitipirorua but it is most likely to have come from this site. The chisel, along with other material was presented to the Museum by Mr Jolly with an accompanying note stating "salvaged from assemblage of unknown provenance almost certainly Whitipirorua on account of presence of many wonder stone [chert] chips and local obsidian".

The chisel is reduced at the upper end and the centrally drilled hole has broken out. At the lower end one side is incomplete but eight teeth or remnants of teeth remain. A further three teeth may have been present in the broken area. The cross-section is crescent shaped.

Two pieces of worked bone, fashioned from lengths of bird limb, may have been tattooing chisel blanks. AR7731/2 (Fig. 79) has parallel sides while AR7731/1 (Fig. 80) has tapering sides. In each case, the bone has been sawn at one end and then snapped, the other end snapped off without preparation, resulting in a rough break. The sides have been ground. The pieces bear a strong resemblance in width and cross-section to the tattooing chisel from the site. Other suggested uses include blanks for fishing lure shanks but the bone is likely to be too thin for this, or alternatively bird spear blanks although the length would possibly be inadequate for this purpose.

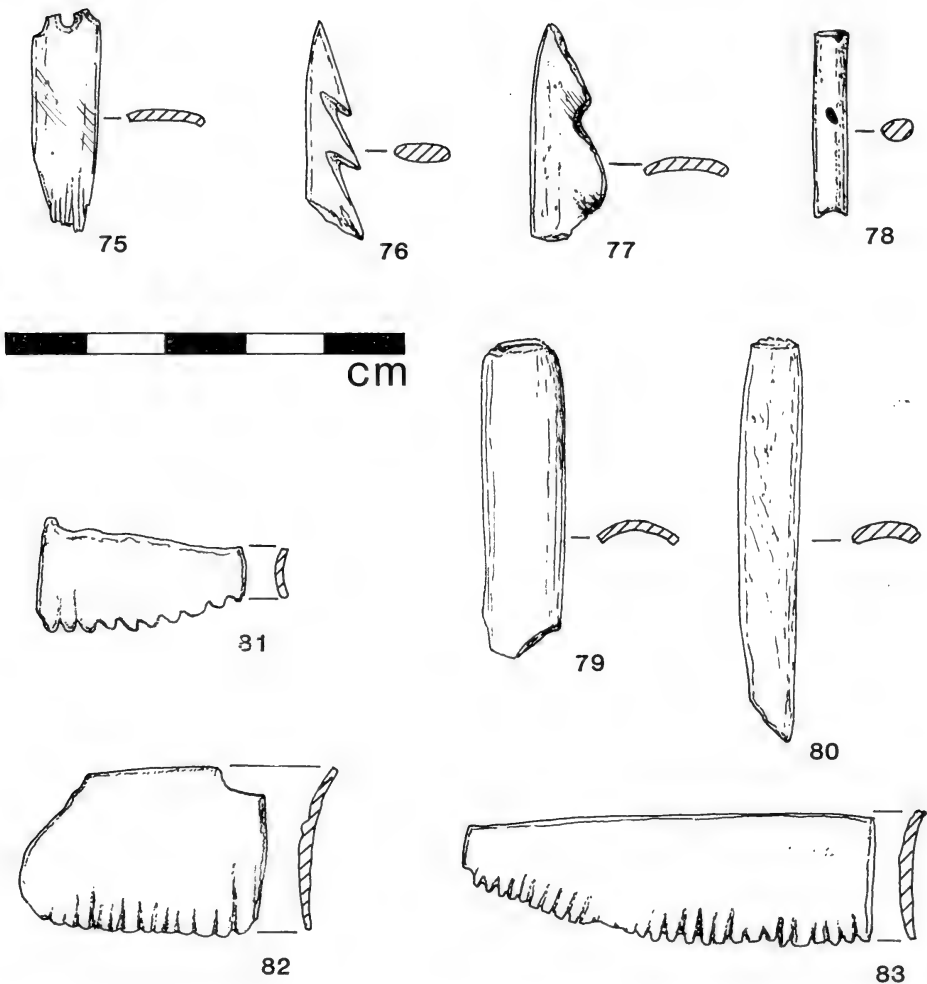
Bird spears

Two bird spears are present in this collection.

AR7730 (Fig.76) is incomplete. Probably made from mammal bone, the spear is solid oval in cross-section. The barbs, on one side only, are worked from front and back.

AR4443 (Fig. 77), also incomplete, is made on a bird limb bone and has a crescentic cross-section. The tip end with two shallow barbs is worked on the front side only and is broken below the second barb.

Bird spears are a rare find from an early site. The only other Coromandel sites to have bird spears are Harataonga (Law 1972:88) and Wheritoa (Crosby 1977:29-30).



Figs. 75-83. Miscellaneous bone and shell artefacts, Whitipirorua site. Tattooing chisel. 75. AR5475. Bird spears. 76. AR7730. 77. AR4443. Bone toggle. 78. AU1598. Bone preforms. 79. AR7731/2. 80. AR7731/1. 81-83. Worked shell. 81. AR7726/3. 82. AR7726/2. 83. AR7726/1.

Bone toggle

An unusual piece of bird limb bone (AU1598, Fig. 78) attracted attention. The ends of the bone, although now ragged, have the remnants of cut surfaces. More importantly, a small hole 1 mm in diameter is centrally situated through one wall of the shaft. The hole is slightly irregular in shape indicating it was punched rather than drilled. Although only 23.5 mm long and with a diameter of 3.6 mm, this object may have been a toggle. While toggles are more commonly larger in size, single strand necklaces or wristlets of, for example, *Dentalium nanum*, may have been secured by just such a small fastener.

Worked shell

Four similar pieces of shaped paua shell (*Haliotis* sp.) have been surface collected from the site in recent years. In addition, another piece was recovered during the 1986 excavation on the site (Furey, in prep.). All pieces were from the same area within the site.

Only one piece is intact (AR7726/1, Fig. 83). The three straight edges have been cut and ground smooth while the remaining edge has 27 notches along its length. AR7726/2 (Fig. 82), is broken but is wider than the previous example. The notches (or teeth) are not as pronounced or as well defined on this piece. Some grinding down of high points of the outer layers of the shell cortex has occurred suggesting it was to fit into, or butt against, another object. AR7726/4 is of similar width to AR7726/2, while AR7726/3 (Fig. 81)), although incomplete, is more like AR7726/1 in shape.

The fragment recovered by excavation, AR7737, was also in the surface sand but can be assigned to a cultural layer deposited in the 15th century (Furey, in prep.).

Worked shell pieces or discs, albeit with all sides notched, have been found in other sites (for example Rakautara Cave, Tumbledown Bay and Oruarangi) and interpreted as decorative insets for wood carvings (Davidson 1984:82).

The function of these particular pieces is not clear. If intended as insets on for example, kahawai fishing lures, it would be unnecessary to notch one side, and ethnographic examples held in the Auckland Museum do not have notching. It is also apparent the pieces were not intended to be pendants similar to the notched paua piece found at Sarah's Gully (Davidson 1986) as there is no form of attachment such as a suspension hole. The grinding of the cortex side on AR7726/2 and AR7737 suggests smoothing for attachment to another object, perhaps a wood carving, where the notched edge would form an important part of the decorative effect.

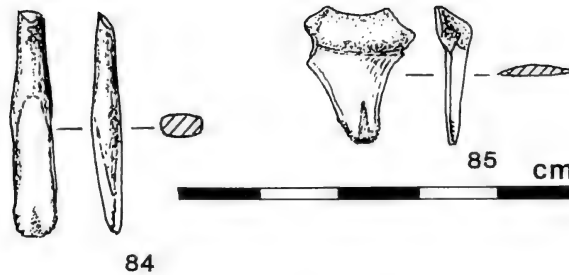
Bone needles

Six bone needles indicate fine sewing was being carried out. None of the needles have an intact eye. All are small in size with a diameter at the upper end ranging from less than 1 to 2 mm. The points on all the needles are very sharp.

Modified shark teeth

Two teeth from the white pointer shark (*Carcharodon carcharias*) have been modified and show evidence of use.

AR2238 (Fig. 84) has been considerably reduced in width and shape and the origin of the object can only be identified from the natural serrations present towards the lower end. The base of the tooth has been blunted and ground. Angled scratches on the enamel front and back above the tooth serrations can be attributed to the grinding or reduction of the sides. Here the enamel has been removed and the dentine exposed. The upper, or root, end of the tooth has also been altered and is a half-circle in cross-section.



Figs. 84,85. Modified shark teeth, Whitipirorua site. 84. AR2238. 85. AR2234.

AR2234 (Fig. 85) is more recognisable as a tooth but has also been modified. Again the end of the tooth is blunted with striations on the enamel and dentine, and like AR2238 the natural serrations towards the lower end have been retained and on both artefacts are intact, showing no signs of wear. There is evidence that the curve of the tooth above the serrations has been formed by reduction of the sides. The root end of this tooth has been modified by removal of the normally protruding sides.

Examination of unmodified white pointer shark teeth indicates that although the pointed lower end of the tooth can be broken off naturally, the vertical chipping, or flaking of the enamel, and the bluntness of the end encountered in both artefactual pieces is not a natural accompaniment.

Modified teeth from the white pointer shark have also been reported from Wairau Bar (Duff 1977:223-224) and Hahei (Harsant 1985:32-33). Duff interpreted the Wairau Bar item as an unperforated tattooing chisel intended for hafting. The Hahei example has a broken suspension hole which led Harsant to suggest use as a pendant. In shape it is very similar to AR2238 from this site, although the point is still intact.

It is unlikely the two teeth from this site were intended as pendants. Shark teeth were used ethnographically for a variety of uses including saws (Barrow 1962) and as drill bits (Best 1974:93). However, the nature of the damage to these pieces could not be attributed to use in either a saw or as a drill bit. The blunting on the end is more likely to have been caused by a chiselling or gouging action and this is reinforced by the evidence of the chipped enamel at the lower end. AR2238 with the upper end very reduced in size could have been hafted although there is no microscopic evidence for this. Certainly the rounded shape at this end is reminiscent of a hafting form.

Bone awls

Three bone awls have been identified. These have been made by grinding a piece of moa bone to a point at one end. Two (AU1522/28 and AR4707) are shown in Figs. 87,88. An awl-like piece of bone, AU1593/18 (Fig. 86), triangular in cross-section, is flaked on two edges at one end and has use polish on the reverse side. This artefact could possibly be interpreted as an awl blank undergoing preliminary reduction before grinding but this would not explain the use polish. A similar artefact, AR224, also has reduction flaking on the sides but does not have evidence of use polish.

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Figs. 86-92. Bone awls and worked bone, Whitipirorua site. 86-88. Bone awls. 86. AU1593/18. 87. AR4707. 88. AU1522/28. 89-92. Worked bone. 89. AU1522/27. 90. AR233. 91. AR4583. 92. AR4707.

Worked bone

A number of pieces of worked bone were recovered. These were from sea mammal or moa and several are illustrated in Figs. 89-92. Various techniques of working the bone are indicated — principally cutting, sawing and snapping (Figs. 89,90,92) and grinding (Fig. 91). Saw marks are usually evident on both sides of the bone with the main cut on one side and a shallow groove on the other to enable controlled breakage.

ADZES

Complete adzes are poorly represented in the collection. There are a number of adze blanks and fragments of blanks. Few of the finished adzes have a high proportion of polish and appear to have been worked by flaking, with a small amount of hammerdressing present. Polish is generally confined to the bevel and blade area with some polish evident on the sides of several of the complete adzes. Reworking or reshaping is also apparent from some of the fragments. The more complete pieces are shown in Figs. 93-97.

Very few of the preforms have reached the stage of bevel formation and in some cases it is difficult to determine if a partial preform is intended to be a blade or butt end. From the number of fragments it is apparent that end shock during manufacture was common.

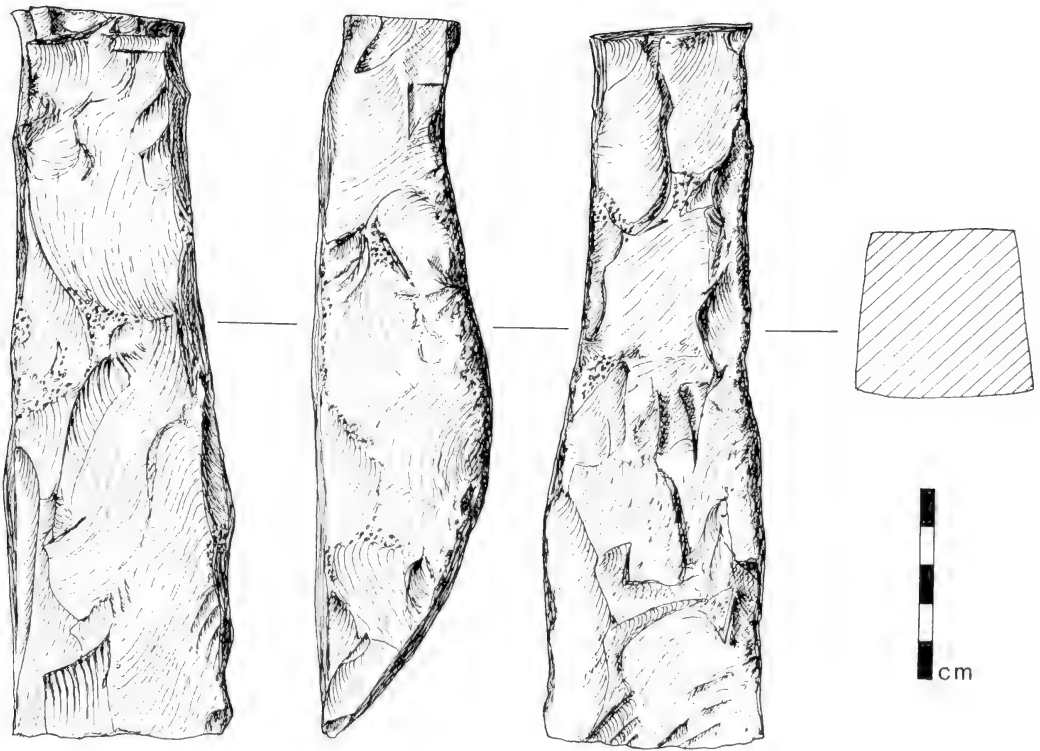


Fig.93. Adze, Whitipirorua site. AR7886.

The adze material, including both finished adzes and preforms, falls into two general cross-sectional shapes, quadrangular and rectangular, although triangular, square, lenticular, and irregularly shaped sections which do not readily fall into any established typology, also occur. However this is not unusual as a large number of adzes and blanks from Coromandel Archaic sites are irregularly shaped in cross-section (Boileau 1980:75; Davidson 1979:199).

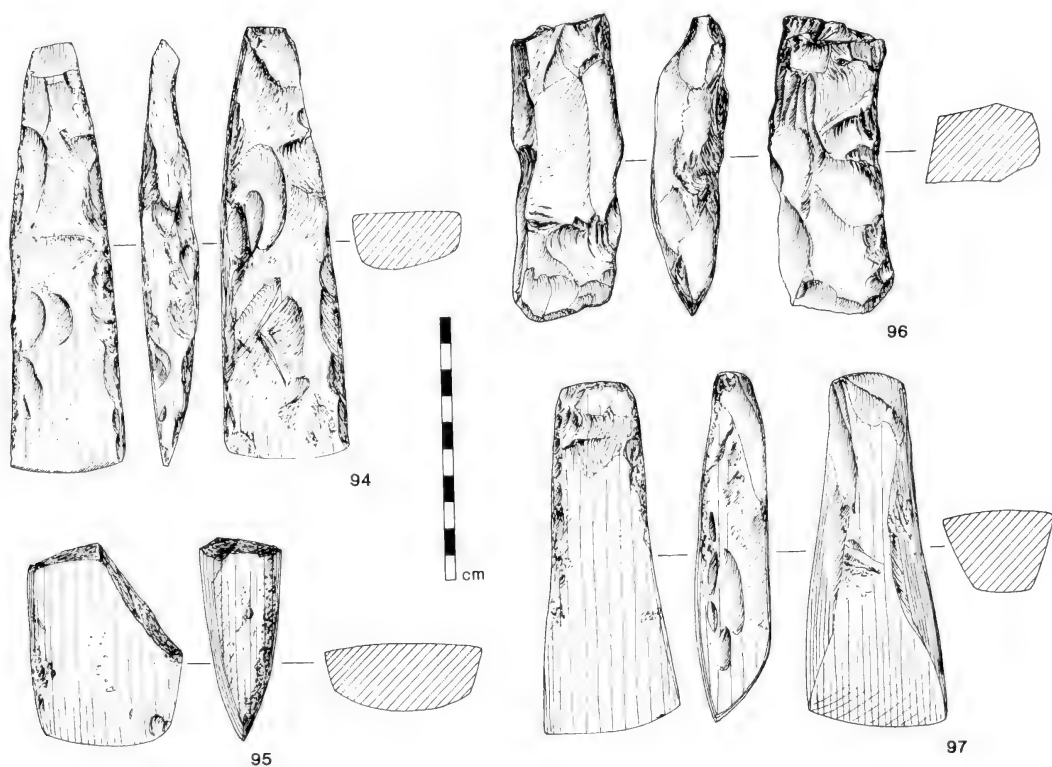
The majority of the adzes and preforms are made from Tahanga basalt. Other stone types, namely metasomatised argillite, non-metasomatised argillite, chert, and a fine grained black basalt also occur.

The complete adzes will be described below, together with a selection of preforms.

Quadrangular adzes

An adze held by Mr Jolly (Jolly Coll. No. 21, AR7886, Fig. 93) is made of Tahanga basalt and has a quadrangular cross-section with the back narrower than the front. The adze most closely approximates Duff's Type 1A. However, because the adze is thicker than is usual in a Type 1A, the cross-section is almost square. The adze is flaked all over with some hammerdressing in the vicinity of the haft area. Two lug-like protuberances occur at the poll end on the back, caused by the detachment of two deep flakes. A striking platform, which forms the poll, indicates the adze was made on a large flake. The adze is thick and heavy-looking for its overall length of 185 mm. The width at the blade is 57 mm.

A small flaked adze in the Jolly Collection (AR7968) is also quadrangular in cross-section with the back narrower than the front. Made from Tahanga basalt the adze is flaked, with some hammerdressing on the sides, and remnants of polish on high



Figs. 94-97. Adzes, Whitipirorua site. 94. AU1372/1. 95. AR4731. 96. AR7745. 97. AR7549.

points on the front and on the back near the blade. No polish is present on the sides suggesting the adze was in the process of being reworked and reduced from an originally wider shape. There is no discernable bevel. The adze measures 80 mm long x 26 mm wide. The width in the vicinity of the blade is 28 mm.

AU1372/1 (Fig. 94), made of Tahanga basalt, has a quadrangular cross-section with the back slightly narrower than the front. The cross-section at the butt end is asymmetrical. The adze most closely fits Duff's Type 2A and is flaked, with polish present on the front and within the general bevel area on the back. There is no defined bevel and the cutting edge of the blade is squared off. This possibly indicates the adze is unfinished and the blade not yet sharpened. Cortex is present on the front and on the poll. The blade width is 45 mm.

AR4731 (Fig. 95), is made of argillite. The adze fragment, of which only the blade end is present, is highly polished all over and has hammerdressing scars on one edge on the front. There is no clearly defined bevel. The cross-section is rounded rectangular with the back slightly narrower than the front. This type of adze is found in early sites as well as being the more common form in later sites.

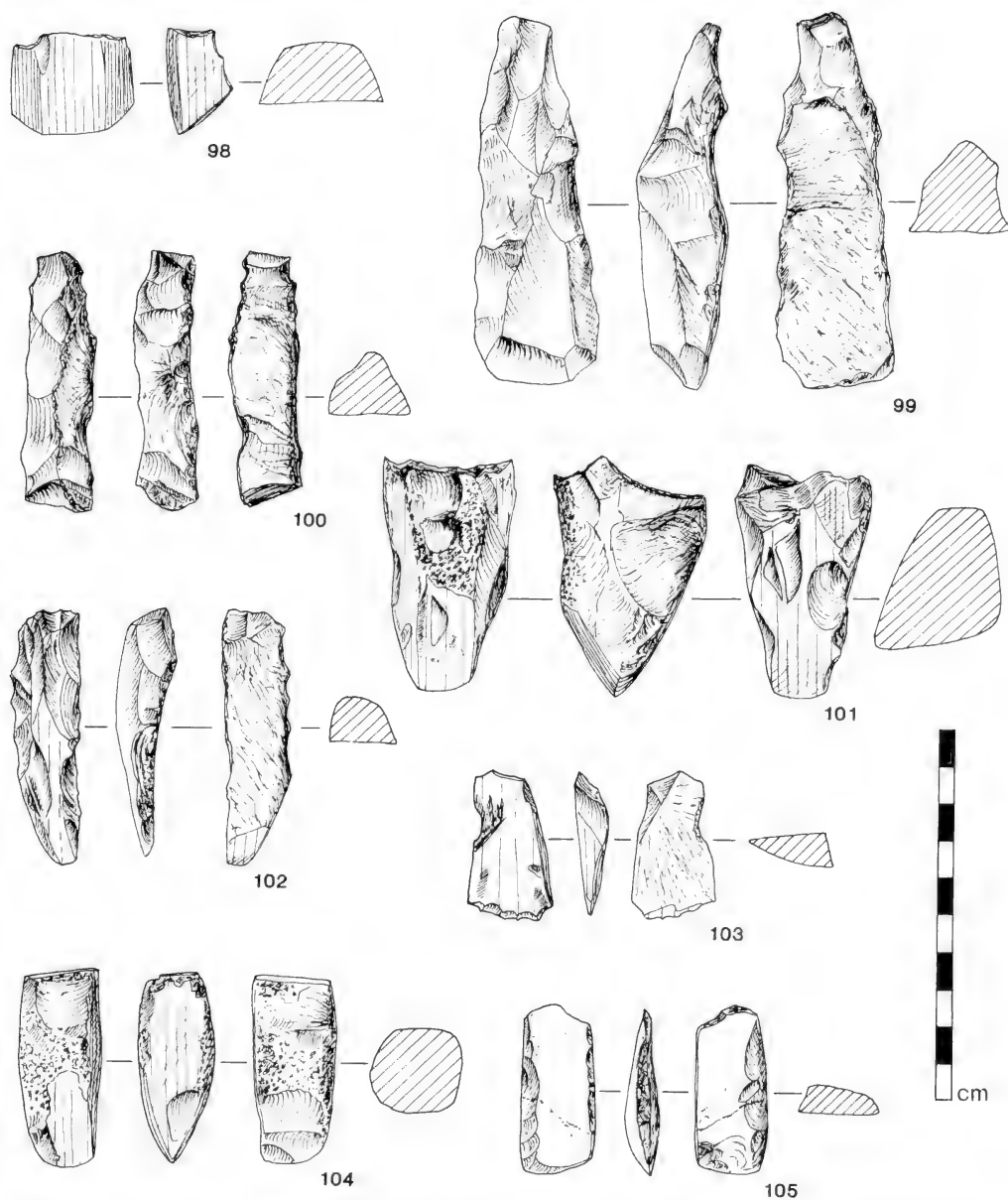
AR7745 (Fig. 96) is a roughly shaped adze made from basalt. Flaked all over, the adze has polish on front and back and a very small amount on one side. The cross-section is quadrangular with the back slightly narrower than the front. The blade is flaked and irregular with hammerdressing scars on one edge, probably as a result of trying to reduce the blade width in this area. The plane of the adze is skewed to one side. Cortex is present on the back although this is very weathered and has considerable use-polish or patina on it. The adze may be the result of an attempt to rework and reshape a damaged artefact. This item was found during the 1986 excavation in an area of fire rakeout and midden, and can be assigned to the third occupation on the site (Furey, in prep.).

AR7549 (Fig. 97), also made from Tahanga basalt, has a quadrangular cross-section with the back narrower than the front. This adze form approximates Duff's Type 2C. The adze has polish all over with flake scars evident on the sides and front near the poll. Hammerdressing occurs on the edges on the front where the adze was lashed to the haft. The blade width is 51.5 mm.

Triangular adzes

AU1593/13 (Fig. 98), of which only a fragment remains, is the blade of what was probably a triangular cross-sectioned hogback adze. The surface is polished all over. The angle of the blade is unusually steep and the blade itself, which is 20 mm long, is slightly curved and very sharp.

AU1372/4 (Fig. 99) is a blank for a triangular cross-sectioned adze made from basalt. The front is relatively unmodified, reflecting its flake origin. Neither blade nor bevel have been formed and the artefact seems to have been a reject, probably because the remnant high point on the back was not able to be removed. There is evidence of bruising in the vicinity of the high point indicating attempts were made at removal.



Figs. 98-105. Adzes and preforms of triangular cross-section, and chisels, Whitipirorua site. 98-100. Triangular cross-sectioned adzes and preforms. 98. AU1593/13. 99. AU1372/4. 100. AR283. 101-105. Chisels. 101. AR7723. 102. AU1281/6. 103. AR7741. 104. AR221. 105. AU1609.

AR283 (Fig. 100) is a triangular cross-sectioned chisel or gouge preform which has been bi-laterally flaked. The stone material is a fine grained black basalt. It is probably part of a larger piece which broke. Some further reduction flaking has occurred at one end.

Chisels

The chisels in the collection are small and functional (Figs. 101-105). Generally not manufactured to any formal type they reflect minimal adaptation of materials available. One exception is AR7723 (Fig. 101), represented by the blade of a basalt hogback Duff Type 4A with a triangular cross-section. The narrow blade, 15 mm wide, is highly polished as is the bevel and existing front portion, although deep flake scars are also present in this area. Hammerdressing is evident on the apex above the bevel area.

AR7741 (Fig. 103) is unique in the collection, being made of metasomatised green argillite. Rounded in cross-section it most closely resembles Duff's Type 6 gouges. Polish occurs on the back near the blade and a small portion remains on the front in the same location. Flake scars and an irregular blade suggest considerable damage, making the chisel unusable in its present form. The blade is ca.13 mm wide. Hammerdressing also occurs on front and back and on one side, the remaining side being highly polished. This chisel or gouge was found in the fill of a pit during the 1986 excavation. Because it may have been fill obtained from elsewhere on the site, it cannot be dated with any confidence (see Furey, in prep.).

AU1281/6 (Fig. 102) is made on a basalt flake which has had secondary flaking to steepen the sides. The cross-section is quadrangular with the front narrower than the back. Polish is present on the front and back and on the sides in the vicinity of the blade which is skewed to one side. The chisel has an overall length of 68 mm while the blade is 6 mm wide.

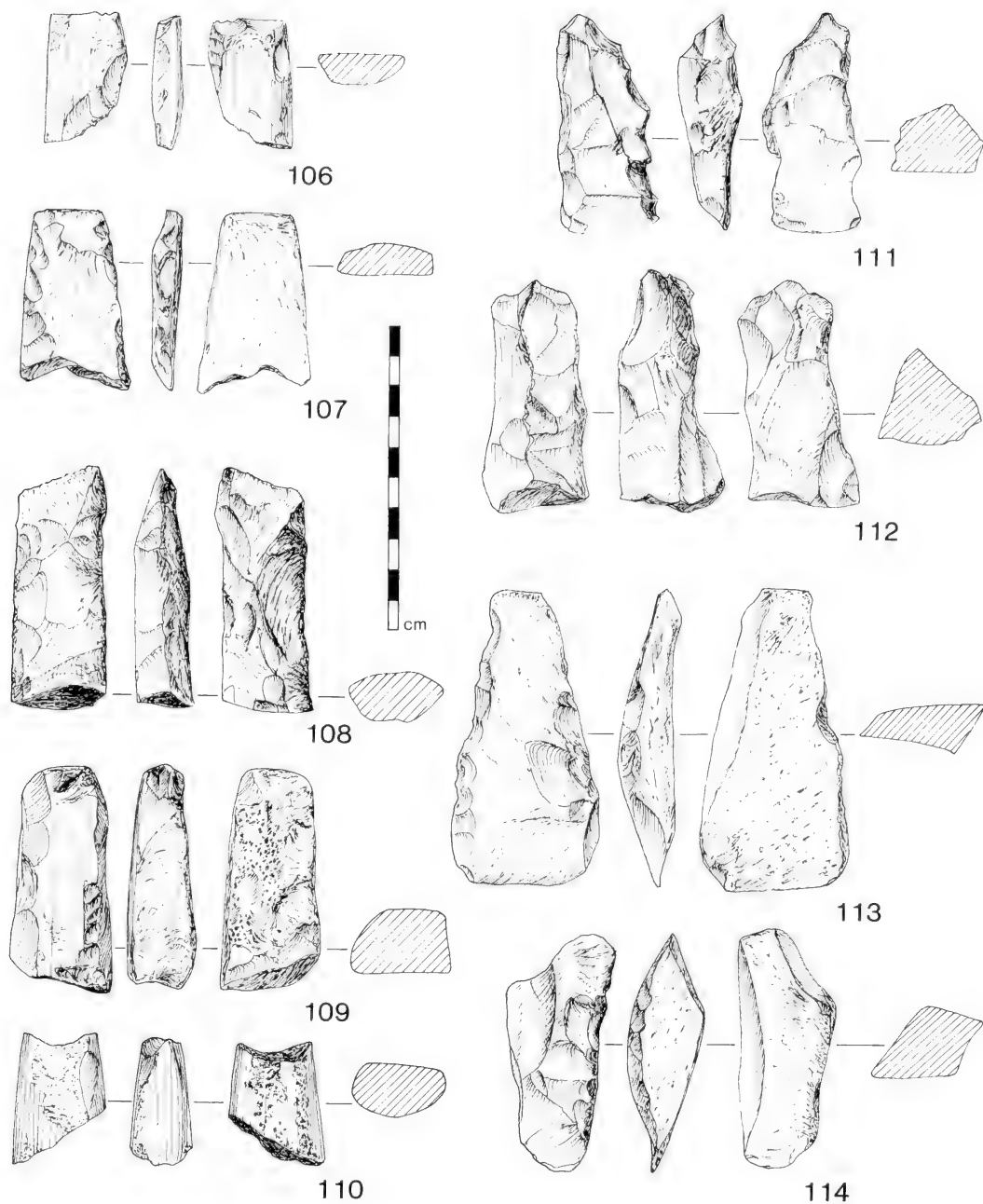
Made on an adze flake, AR221 (Fig. 104) is an example of re-use of stone material. On the front and one side the chisel has polish from the original adze. The flake has been ground on the remaining side and on the back near the lower edge to form the chisel blade. The blade is chipped along its length and is no longer straight. The blade length is now difficult to determine but would not have exceeded 21 mm.

AU1609 (Fig. 105) is made on a small chert flake and is irregular in cross-section. Reduction flaking has occurred on the sides. Flaking is also present on the front at the blade end but this is more likely to have been caused by use rather than shaping. Polish is present near the blade on the back and also on the sides of the chisel, except in the vicinity of the haft lashing. The length is 45 mm while the blade width is 17 mm.

Miscellaneous adzes and preforms

The following adze fragments (Figs. 106-110) have been included to show the variety of cross-sections and shapes found in the adze material from the site.

AR268 (Fig. 108) is a triangular to lenticular cross-sectioned adze or chisel blank made of a fine grained basalt. Quadri-laterally flaked all over, like many other blanks from the site it appears to have broken during manufacture.



Figs. 106-114. Adzes of miscellaneous form and flake adzes, Whitipirorua site. 106-110. Miscellaneous adze forms. 106. AR6336. 107. AR4887. 108. AR268. 109. AR4824. 110. AR4726. Chert preforms. 111. AR204. 112. AR4892. Flake adzes. 113. AU1372/2. 114. AR4653.

AR4887 (Fig. 107), again made of basalt, has a flat cross-section and is made on a flake. One surface displays the unmodified positive bulb of percussion while the other side has small reduction flake scars near the edges. The sides are ground up to the butt.

AR6336 (Fig. 106) is part of a small basalt adze or chisel with polish on all surfaces. Like AR4887 it has a flattened cross-section and is represented by the mid-portion of the tool.

AR4824 (Fig. 109), also made of basalt, is an example of a reworked adze. Probably originally of quadrangular cross-section, it is now asymmetrical, having been reworked along one side. Polish occurs on the upper surface and a small amount is on the reverse side near the break. Flake scars on the newly formed side and on the reverse side have been hammerdressed. It probably represents the butt end of an adze.

AR4726 (Fig. 110) is part of an asymmetrically cross-sectioned basalt adze or chisel which reduces in width at one end. It is polished over most of the surface.

Chert adzes

In addition to the chisel illustrated in Fig. 105 five small reject adze blanks made from chert are in the assemblage. Two are illustrated in Figs. 111, 112. The remaining three are irregularly shaped in cross-section.

AR204 (Fig. 111) has a sub-triangular cross-section with the back narrower than the front. A protrusion on one side which was not able to be removed has probably led to this piece being rejected.

AR4892 (Fig. 112) is also a sub-triangular section piece which narrows slightly at one end. The blank is incomplete and appears to have broken through end shock during manufacture.

Flake adzes

The flake adzes in the collection show minimal modification and are essentially flakes which have a small amount of polishing, or have use-polish to indicate that they have been used in an adzing or chiselling fashion. A number of the other adzes previously described are also flake adzes in the strict definition, in that they were made on flakes, but they have undergone further shaping and modification.

AU1372/2 and AR4653 (Figs. 113, 114) are basalt flake adzes of irregular shape and cross-section. AU1372/2 has bi-lateral reduction flaking on one side and a small amount of polish on high points near the positive bulb of percussion. The reverse side is cortex. The blade, which has use polish, is otherwise unmodified.


AR4653 also has minimal modification. The broad striking platform of the flake forms one side of the adze. A large protuberance juts out the other side. Flakes have been removed from the blade area to steepen the angle on one side and polish occurs on high points on front and back. The curved blade also has a small amount of polish.

The remaining fragments of adze and chisel blanks in the collection are all made from Tahanga basalt.

HAMMERSTONES

Five hammerstones (Figs. 115-119) have been identified from the characteristic bruising apparent on one or more surfaces. Four of these are natural water-rolled cobbles while AR6234 (Fig. 118) was originally the butt end of a basalt adze preform.

AR4421 (Fig. 116) has a bruised and flattened appearance around the entire circumference. The impact points on the remaining hammerstones are indicated on the illustrations.



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AU1385 (Fig. 115) and AU1593/3 (Fig. 119) are of a coarse silicified sandstone material, while AR4421 (Fig. 116) and AR6619 (Fig. 117) are both ignimbrite. These stone materials are available in places along the eastern coast of the Coromandel Peninsula (Anon. 1968, 1975: Geology maps).

DRILLPOINTS

A large number of drillpoints, approaching several hundred, have been recovered from the site. A selection of these are illustrated in Figs. 120-153.

The majority of the drillpoints are chert, ranging from sinter through to fine grained cherts sometimes called jasper and chalcedony, but argillite (AU1716/10, Fig. 127), obsidian (AR203, AR7866; Figs. 123,126) and basalt (AR4623, AR4933, AR4453, AR4830; Figs. 124,129,139,150) also occur. The range of sizes available is indicated in the illustrations.

Two cross-sectional shapes, triangular and rectangular, are apparent and as Harsant (1985:21) found, the method of manufacture and direction of flaking is different for each shape. Rectangular shapes were formed by uni-facial bi-lateral flaking, while triangular drillpoints have uni-facial or bi-facial tri-lateral flaking.

Examples of double ended points occur (AR346, AR4894; Figs. 135,146) although these are not common.

STONE FLAKES AND FLAKE TOOLS

A large amount of stone material is present in the collection. In excess of 60 kg of flakes of chert, basalt and obsidian have been recovered, roughly in proportions of 45%, 35% and 20%. Cortex is present on many of the flakes of all three stone materials. No analysis has been carried out.

The basalt is consistent in texture and a range of flake sizes is apparent. The number of cortex flakes suggest unmodified boulders of Tahanga basalt were being brought to the site for adze manufacture, although importation of some adze blanks, prepared at the Tahanga source, cannot be ruled out.

Both green and grey coloured obsidian were present. A large proportion of the grey coloured flakes had cortex on one or more surfaces, suggesting small cobbles were being used. This is consistent with the form of the obsidian which occurs naturally at Whitipiroua (Onemana) and over the wider Whitipiroua Peninsula area collectively known as the Whangamata source. The green obsidian is most likely from Mayor I, less than 35 km distance. A count of one randomly selected bag of flakes (AU1301) indicated 84 grey coloured flakes and 15 green flakes. These proportions are probably typical of the obsidian assemblage overall.

The chert is most likely from a local source and ranges from sinter, with quartz particles embedded in a rough textured cortex, to a finer grained chert. Water rolled curved surfaces also occur.

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Figs. 120-153. Drillpoints, Whitipirorua site. 120. AR4990. 121. AR7493. 122. AR4990. 123. AR203. 124. AR4623. 125. AU1592/7. 126. AR7866. 127. AU1716/10. 128. AU1722/12. 129. AR4933. 130. AR350. 131. AR4990. 132. AR346. 133. AR307. 134. AR267. 135. AR346. 136. AR4693. 137. AR4990. 138. AR267. 139. AR4453. 140. AR4439. 141. AR4616. 142. AR350. 143. AR267. 144. AR4990. 145. AR4629. 146. AR4894. 147. AU1603. 148. AR4629. 149. AR4990. 150. AR4830. 151. AR4629. 152. AR4857. 153. AR267.

Within the large amount of stone material from the site were several flaked pieces which showed evidence of further modification or use wear. A selection of these are shown in Figs. 154-159 and Figs. 160-164.

One type are the stone 'awls' with secondary flaking on two sides to produce a point. AR7729 (Fig. 159), made from a basalt flake, is one such tool. The point has broken off. A similar tool, also in basalt, (AR4803, Fig. 158) has reduction flaking along one edge. These tools may have been hand-held and used for working wood.

AR4577 (Fig. 156) is the butt end of an adze preform and has hammerdressing on the edges. The fracturing of the stone created a point which has been subsequently used as a tool, perhaps for the same purpose as the 'awls' described above. The point of this tool has considerable use polish and wear.

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AU1524/2 (Fig. 154) and AR4922 (Fig. 155) have similar patterns of usewear. AU1524/2 has considerable usewear and polish on the narrow end, with a curved end reminiscent of a blade 6 mm in length. Use polish on the back and sides near this blade suggests the tool was used in a chisel-like fashion. The blade may have been ground. AR4922 is an unmodified cortex flake which also has evidence of usewear and smoothing or polish at the narrow end. Both pieces are Tahanga basalt. A rubbing action on harder materials such as wood or bone is more likely to have produced the distinctive use-polish on the harder basalt than a similar action on skin or fibres. Tools resembling these are described from the Wheritoa site where Crosby (1977:9-10) interpreted them as hand-held grooving tools. A basalt point from Hot Water Beach, described in Leahy (1974:51-52), may be a similar tool but specific references to this type of tool are lacking from reports on other Coromandel Archaic sites.

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Figs. 160-164. Obsidian and chert, Whitipirorua site. 160-163. Obsidian. 160. AR4981. 161. AU1385. 162. AR4663. 163. AU1285/4. Chert. 164. AR4800.

Some obsidian flakes and cores also showed evidence of further modification. All were green in colour, suggesting a Mayor I source. The use damage on AU1285/4 (Fig. 163) is consistent with it having been used as a 'spokeshave'. Heavy uni-lateral use wear is present in a concave-shaped bite on the flake. AR4663 (Fig. 162) is a triangular cross-sectioned flake with bruising on the narrow pointed end. The point is curved and blade-like and is not dissimilar to the basalt 'grooving tools' described above. AR4981 (Fig. 160) is a large obsidian core with bruising or blunting of raised flake ridges at the upper end. This would be consistent with modification for hand-holding, perhaps to use as a heavy chopping or butchering tool. The opposite end shows some evidence of use-wear. AU1385 (Fig. 161) has usewear along the curved side.

A chert piece (AR4800, Fig. 164) with cortex on two sides has a rectangular cross-section and has had trimming flakes removed from both sides at the lower end. There is no evidence of usewear on this surface but chert, being relatively hard, may not show evidence of wear unless use was prolonged or the opposing material very hard or abrasive.

STONE FILES AND ABRADERS

A large number of sandstone files, file fragments and file blanks are included in the collection. A selection are illustrated in Figs. 165-194. The material is a partly silicified sandstone which varies from a fine through to a coarse grained texture. It is likely these derive from sedimentary deposits associated with the Whitianga Group geological formation which occurs within the wider local area (R. Brassey, pers. comm.).

The technique of file manufacture is similar to that described in Law (1970) where blocks of sandstone were sawn or pecked and the resultant groove snapped through, creating two file blanks or roughouts. It is likely the blocks were initially prepared by flaking to a rounded or oval shape before being split, thus accounting for the large amount of small flakes or chips of sandstone present. Fig. 165 (AU1375) shows the method of splitting larger blocks while Fig. 166 (AR4964) illustrates a shaped, but unused, file.

The files can be grouped into several categories. The majority are oval in cross-section with a rounded head.

Several have a shaped head (AR4672, AR4748, AR306, AR4667; Figs. 182, 180, 183, 173) and may have had a particular function, for example, smoothing the inner curve of one-piece fishhooks.

A second group has a flat cross-section (AR4763, AR352 and AR315/AR349 which fit together; Figs. 184, 192, 194). Two of these (AR4763, AR315/AR349) are of a finer grained sandstone and both are worn on one side suggesting a specific use such as scarfing the notches for the line lashing on fishhooks (D. Bonica pers. comm.). AR352, although ground on all surfaces, has squared edges.

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Figs. 165-194. Stone files, Whitipirorua site. 165. AU1375. 166. AR4964. 167. AR326. 168. AR4573. 169. AR4797. 170. AU1722/11. 171. AR316. 172. AU1522/57. 173. AR4667. 174. AR264. 175. AR347. 176. AR7493. 177. AR347. 178. AR4886. 179. AR347. 180. AR4748. 181. AR4886. 182. AR4672. 183. AR306. 184. AR4763. 185. AR4850. 186. AR4636. 187. AR4459. 188. AR4886. 189. AR4762. 190. AU1281/1. 191. AU1591/1. 192. AR352. 193. AR4743. 194. AR315/AR349.

Two files are rounded in cross-section (AU1281/1, AU1591/1; Figs. 190, 191) and are of a larger diameter. AU1591/1 has a small rounded tip. One triangular cross-sectioned file (AR4797) is illustrated in Fig. 169, and an unusually shaped piece, AR4743 (Fig. 193) shows heavy use with four curved surfaces.

HOANGA

Five hoanga, or grindstones, of the same material as the majority of the sandstone files, are present. Several have two or more worn surfaces. The largest, AR565, is 215 x 120 mm and is smoothed on only one surface.

PUMICE

A large amount of pumice was present in the samples recovered from the site. The majority was in a natural state, having a smooth, rounded appearance consistent with having been sea-raftered, and showing no evidence of use or alteration.

Nine artefactual pieces were identified, ranging from possible abraders to shaped and drilled objects of unknown function. Seven of these are shown in Figs. 195-201.

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Figs. 195-201. Pumice, Whitipirorua site. 195. AR281. 196. AR7722/1. 197. AU1593. 198. AR7722/2. 199. AU1293. 200. AR7721. 201. AR4419.

Three pieces may have been used as abraders. AU1293 (Fig. 199) has several curved surfaces suggesting it has been rubbed back and forth across another object, while AR7721 (Fig. 200) is file shaped. The third piece identified as an abrader is a natural pumice piece with one flattened surface and the dark outer cortex has been removed.

AR7722/1 (Fig. 196) has two small grooves at one end, indicating use for smoothing or polishing a small bone or wood shaft. AU1522 with a groove at one end may have had a similar function.

AU1593 (Fig. 197), although incomplete, has been shaped on the outer edge and the centre is in the process of being drilled or gouged out from both sides. Similarly, AR4419 (Fig. 201), also incomplete, may have been shaped on the outer curve and has scars from two drill holes. The function of both of these is unknown but shaped pumice is present in other sites.

AR7722/2 (Fig. 198) shows a piece that has two opposing depressions, one on either side, connected by a shallow straight-sided groove over the curved surface of the object.

A piece with a depression in one surface, AR281 (Fig. 195) completes the collection of pumice artefacts.

FISHING SINKER

A water-rolled ignimbrite pebble (AR6213, Fig. 202) with a pecked groove around its circumference is most likely a fishing sinker. It measures 60 x 46 mm and weighs 172 g.

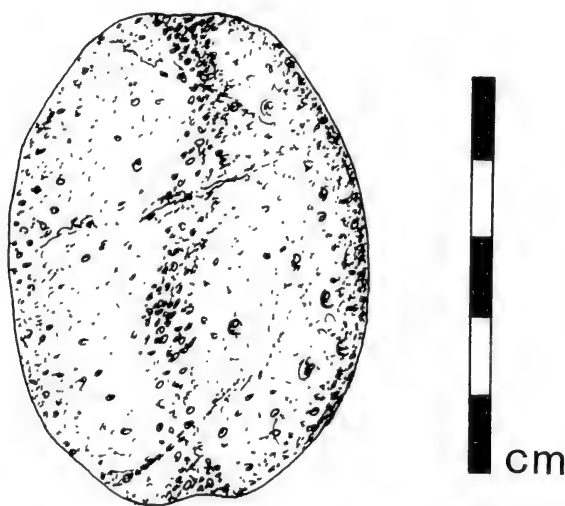


Fig. 202. Fishing sinker, Whitipirorua site. AR6213.

BONE MATERIAL

Sea mammal, whale, moa, dog, bird and fish bone, present in the collection, have yet to be identified and speciated.

It is apparent that moa were hunted for food during at least one occupation of the site. The amount of moa bone and the presence of moa eggshell from several separate locations within the site indicates contemporaneity of moa and the site's occupation. This is in contrast to several other sites (for example Wheritoa) where it was suggested that the small amount of moa bone may have been imported or have been sub-fossil.

THE SITE

The site takes its name from the traditional name for the area, identified on a Land Court map (ML2569) dated 1872. Onemana, the present name for the beach, was adopted in the 1970's as the name of the beach subdivision but has no traditional relationship to the area.

Onemana Beach has one main stream which flows out near the centre of the beach. The Whitipirorua site extending over a distance of about 200 m was situated between this stream and the intermittent watercourse near the southern end of the beach (Fig. 2).

Before the residential subdivision in 1974, the beach dunes backed up to steep-sided spurs. The dunes themselves were of a higher level than the adjacent beach. Bare patches in the dune vegetation, evident in aerial photographs of 1966 (Run 1894, Photos H/16 and 17) indicate surface erosion was occurring.

Recontouring of the spur ends and the dune area took place in conjunction with the residential development. Spoil from the spurs was pushed forward over part of the dune area, probably preserving part of the site under several metres of clay and a tennis court. A toilet block was built on the site itself and now marks the northern boundary of the remaining intact cultural material.

The site continues to erode on the seaward margin, with at least 25 m having been destroyed in one particular place over the last 15 years.

The Onemana area is well-endowed with the obsidian and chert stone materials utilised in the site. Chert outcrops occur on the ridges behind the beach although there is no evidence that these particular outcrops were used (J. Coster, pers. comm.). The chert utilised in the site is more likely to have come from a stream or beach as many flakes have a water-rolled cortex.

Obsidian, in the form of small cobbles and boulders about 20 cm in diameter, is found in the clay of the spurs backing the beach. It also occurs in the stream beds and beaches on the Whangamata Harbour side of the Whitipirorua Peninsula (J. Coster and P. Moore pers. comm.).

In 1986, the author carried out a small investigation of an eroding part of the site to document the stratigraphy and obtain suitable samples for radiocarbon dating. The results of these investigations will be presented in due course (Furey, in prep.). Briefly, the stratigraphy from the excavation can be summarised as representing three occupation layers separated by sterile sand. These occupation surfaces occurred over most of the excavated area. In one area there is the potential for one or two additional earlier occupations (the lowest layers were not fully excavated in this square).

Radiocarbon age estimates for the earliest investigated occupation level, based on pipi shell, had a conventional age of 990 ± 50 years BP (WK1515). Using the carbon cycle model calibration curve of Stuiver, Pearson and Braziunas (1986), there is statistically a 85% confidence level that the occupation fell within the period 1285AD-1437AD with a median age distribution of 1359AD. The most recent occupation, with an age estimate obtained on cockle shell had a conventional age of 870 ± 45 years BP (WK1169). There is a 95% confidence level the occupation falls within the period 1352-1521AD with a median age distribution of 1444AD.

Several Archaic sites occur within a small area on this part of the Coromandel east coast. In addition to Whitipirorua, Archaic-type artefacts have been recovered from N49/33 (T12/26), also known as Whitipirorua Site 3 (Jolly 1978a), and from Whangamata where two closely located sites, Whangamata Wharf site (Allo 1972) and Cabana Lodge (Jolly 1978b) occur at the mouth of the Whangamata Harbour (Fig. 1). There are also unsubstantiated reports of Archaic material being found near the mouth of the Otahu River at the south end of Whangamata. With the exception of Whitipirorua, none of these sites have been dated.

DISCUSSION

The artefacts from Whitipirorua bear a strong resemblance to artefact assemblages from other earlier sites on the Coromandel east coast. Davidson (1979) provided a summary of major artefactual material recovered from some of these sites, and further excavations and reports have subsequently added to this.

It is apparent that the Whitipirorua site has the most extensive range of Archaic material of any of the reported Coromandel sites. This is possibly due to the methods of collection which covered a long period of time ranging over the entire site. Other sites such as Hot Water Beach, Hahei and Opito Beach Midden (N40/3) produced a number of artefacts within a more restricted range and confined to small archaeologically excavated areas. A wide variety of artefact types is also known from the Wheritoa site where, like Whitipirorua, a considerable amount of unrestricted and uncontrolled collecting activity took place.

The Archaic assemblage, excluding adzes, as defined by Golson (1959) is well represented, reinforcing the theory of homogeneity of artefact types in the early period of settlement from sites that are geographically distanced. In addition to the early 'marker' artefacts such as bone reels, other artefact types, for example perforated shark's teeth, bird spears and *Dentalium nanum* shell segments, which occur throughout the prehistoric period are also demonstrably early and are likely therefore to be based on styles with origins in Eastern Polynesia. Some of the artefact types in

the Whitipirorua site have direct parallels in East Polynesian culture. Several of the trolling lure shanks, and ornaments such as perforated teeth, imitation whale tooth units and reels, stand out as being very similar to artefacts from sites in the Marquesas and Society Islands which have been dated to around the accepted settlement period of New Zealand.

While the large majority of the artefacts from the Whitipirorua site cannot be dated, the radiocarbon dates from recent excavations on the site, and the absence of any occupation layers post-dating the 15th century, enable the artefacts to be securely assigned to the Archaic period and thus can be attributed to within the first few hundred years of this settlement period.

Several observations, relating to both the artefacts and a wider cultural significance, can be made from the study of the Whitipirorua collection.

There is a lack of finished and complete adzes from the site compared with other collections from early sites elsewhere, for example the Brambley Collection from Manukau South Head (Prickett 1987). Like other Coromandel sites there is a high proportion of roughouts to finished adzes, indicating adze manufacture was an important activity which Harsant (1985:35) suggested may have been directed towards trading of surplus tools. In addition, with a few exceptions, the adzes and preforms present do not fit into the formal typology developed by Duff (1977). Made from Tahanga basalt, the adzes and roughouts follow the trend observed on other Coromandel sites where more irregularly shaped adzes predominate (Boileau 1980:75, Crosby 1977:8 and Harsant 1985). This may be specifically related to the use of Tahanga basalt (Davidson 1979:199). The adzes from this site, like assemblages from other excavated sites, tend to have minimal finishing polish — the tools are flaked and flake scars hammerdressed to remove high points.

It is also apparent that there was a heavy reliance on local Coromandel stone materials for tool manufacture. Tahanga basalt from Opito was obviously a very important source of stone for adzes. With the exception of three items, the remainder of the finished adze fragments and roughouts were made of Tahanga basalt. The number of waste flakes, many of which had a curved cortex surface, suggests that weathered boulders or partially prepared blocks of basalt were transported to the site and further reduced into adzes. The on-site manufacture of adzes is also demonstrated from Hahei, Wheritoa and several of the Opito sites (Harsant 1985; Moore 1976:88). It is also apparent from several of the roughouts that re-working and re-shaping of adzes was carried out.

There was also a heavy reliance on the local obsidian and chert which can be found near the site. Obsidian presumed to be from Mayor I (P. Moore, pers. comm.) was also present but in small quantities. This is in contrast to all other Coromandel Archaic sites where Mayor I obsidian predominates, even when local sources occur nearby (for example, Hahei). Interestingly, the Whangamata Wharf site, situated immediately across the narrow harbour from an obsidian source, contained a high proportion of obsidian presumed to be from Mayor I (Allo 1972:66).

The presence of stone, namely schist and metasomatised argillite, from South I sources indicates trade of finished artefacts or raw materials. It is more likely that finished tools were transported to the site as there is an absence of the waste material of manufacture.

The most predominant artefact type at Whitipirorua was the fishing gear. Both trolling and line fishing was important and several of the trolling lure shanks are of a type not commonly found on the Coromandel Peninsula.

The heavy reliance on fishing, adze manufacturing using local Tahanga basalt, and the similarity in appearance to other Coromandel sites suggests a cultural homogeneity spanning several hundred years. Several authors (for example Law 1982:60) have raised the question of why cultural changes occurring immediately outside the Coromandel Peninsula were not adopted by people occupying these sites. One explanation lies in the apparent similarity in content of sites over a considerable time period, and possibly indicates a tradition of conservatism displayed through artefact styles and the subsistence economy based on fishing and birding.

Further archaeological research needs to be carried out on the Coromandel Archaic sites, concentrating not on the artefact and faunal rich beach middens, but on the associated settlements. To date only one Archaic site, Sarah's Gully, which included all components of the settlement has been investigated and has not yet been fully reported on.

Acknowledgements. This paper could not have been written without the assistance of a number of people.

Nigel Prickett, archaeologist, Auckland Museum, made the collection available for study and provided advice and encouraging discussion.

The late Mr Bob Jolly shared memories of the site with me and allowed several artefacts in his personal collection to be drawn and described. Without Mr Jolly's enthusiasm and energies on the site over a period of years, a major assemblage of artefacts would have been lost to research. Mr Jolly bequeathed his collection of artefacts to the Auckland Museum where they are now held.

Joan Lawrence illustrated the artefacts and helped to clarify some problems with descriptions of adzes.

Kath Prickett and Robert Brassey helped identify stone materials in trolling lures, adzes, stone files, hammerstones and drillpoints. Dante Bonica provided information on the uses of stone files and shark tooth drillpoints. Phil Moore confirmed the use of Whangamata and Mayor I obsidian sources after comparing a selection of flakes from the site to known source samples.

Bruce McFadgen recalibrated the radiocarbon dates from the site using the Stuiver, Pearson and Braziunas carbon cycle model calibration curve.

Molly Hougaard (Nicholls) shared her recollections of the site as it was in 1964.

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COMBS FROM ROCK SHELTERS IN THE WAITAKERE RANGES, WEST AUCKLAND

JOAN LAWRENCE

AUCKLAND

Abstract. A number of well preserved combs, some in varying stages of manufacture, collected from caves and rock shelters on the west coast of Auckland, New Zealand, earlier this century are described. One is of whalebone, while the remainder are of wood, either one-piece or composite. The one-piece combs are similar stylistically but are smaller than combs from other archaeological collections. Two of the composite combs have intact flax bindings, and all the finished combs are stained with oil and red ochre. These combs are of a form that suggests they are of the later prehistoric period.

West Auckland in the northern North Island, is an area largely surrounded by water. The west coast is bounded by the Tasman Sea and lies exposed to the prevailing weather. The extensive harbours and estuaries of Manukau and Waitemata are situated to the south and east. The area to the west is dominated by the heavily forested Waitakere Ranges which rise to 480 m elevation and stretch southwards from Muriwai Beach to the Manukau Heads (Fig. 1).

Strong evidence of prehistoric occupation is found predominantly on and near the coastlines. There are some 550 recorded pre-European archaeological sites, including 53 pa and associated undefended terraces, over 200 middens, 70 pit complexes and almost 100 individual caves and rock shelters (Hayward & Diamond 1978). The extensive artefact collection from the Waitakere Ranges is rich and varied. In particular, the excellent preservation of wood and fibre artefacts found in the numerous caves and shelters is probably unsurpassed in New Zealand uncontrolled or surface collections.

No scientific archaeological excavations have been conducted in the Waitakere Ranges, but artefact collection ranged from the indiscriminate fossicking by the first timber workers in the late 19th century, to the systematic exploration of cave shelters and other sites by such amateur archaeologists and collectors as G. Nevill, F. Mappin and A.T. Pycroft, G. Fairfield and J. Donald, W.E. Browne, T. Lloyd and E. Willis from the 1930s-1950s. Other collections in the Auckland Institute and Museum belonged to the families of early European settlers in the area such as the Bethells of Te Henga and the Bishops of Titirangi. Former Director of the Auckland Museum, Gilbert Archey, and Ethnologist V.J. Fisher also collected surface finds from the west coast beaches as did Assistant Director, A.W.B. Powell, and Botanist Lucy Cranwell.

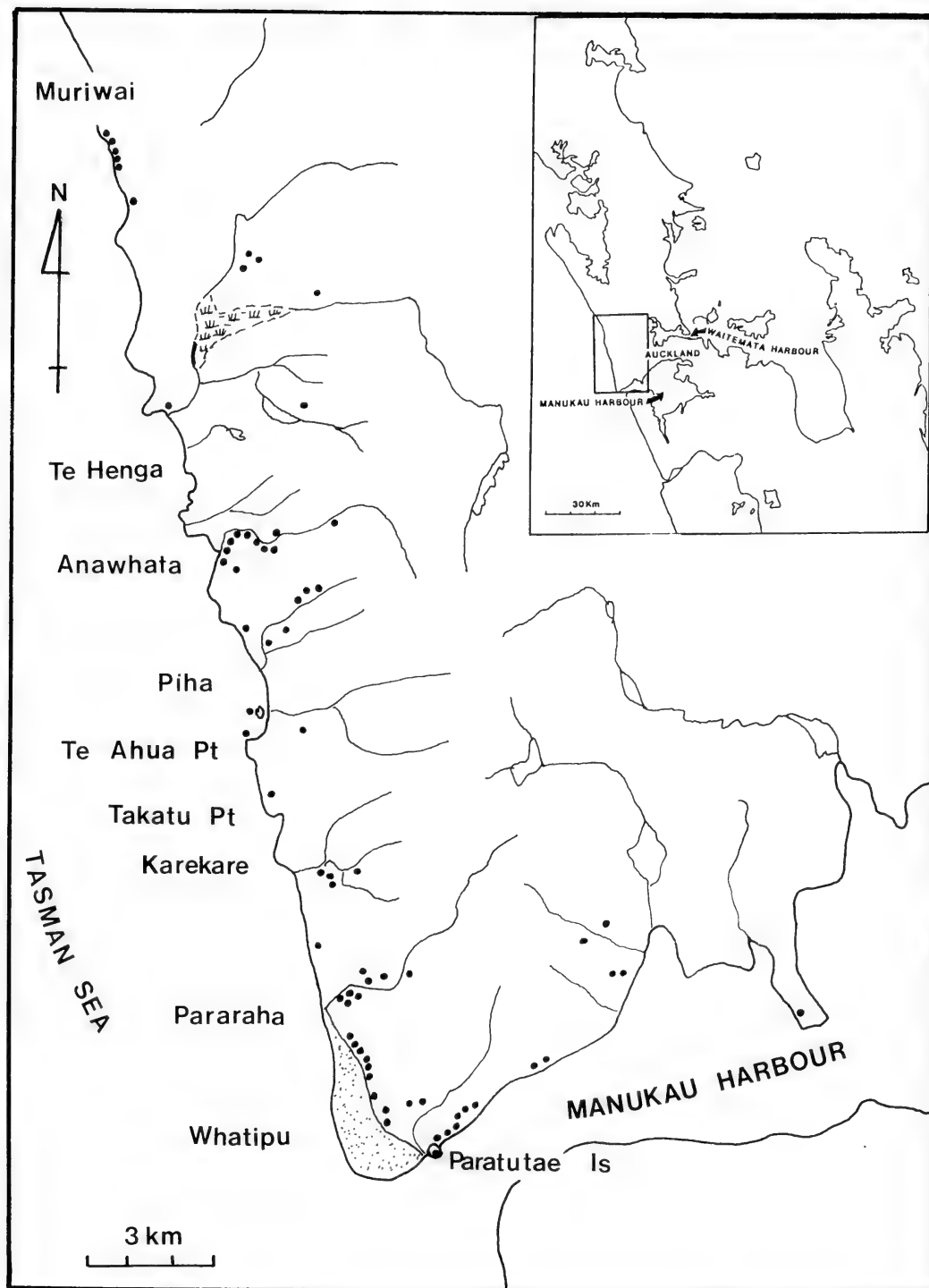


Fig. 1. Location of caves and rockshelters, Waitakere Ranges, West Auckland.
Inset. North Island location.

Combs described in this paper come from a number of different sources. The majority are from the Auckland Institute and Museum collection and are identified by an accession number with prefix, as 47234. The letters ME precede the accession number from artefacts lodged in the National Museum, Wellington, as ME 13244. Otago Museum artefacts are prefixed with the letter D, as D 37.3.

Twenty-six combs have been recovered from coastal caves and rock shelters of the Waitakere Ranges (Figs. 2-27). One is of whale bone, and the others, including two blanks, are made of wood. The wood has been identified as *mapara* or *kapara*, the highly resinous heartwood of rimu, though of twelve combs examined microscopically, one (Fig. 15), was an exception, the wood being identified as broadleaf. All combs from the Bay of Plenty swamp sites Kohika (N68/140) and Kauri Point (N53-54/5) are made of *mapara* (Rod Wallace, pers. comm.).

There are 18 simple one-piece combs. The remainder are composite, consisting of separate teeth lashed together with flax fibre. Two are charred by fire (Figs. 18,26) and a further seven may have been deliberately broken. Two combs are in the process of manufacture (Figs. 6,22).

Most of the combs are ochre stained and impregnated with oils. This may have been a significant factor in their preservation, as the wood of combs in the process of manufacture (Figs. 6,22) showing no evidence of ochre or oils, is split and frayed. Oil and ochre may have accumulated through contact with kokowai (red ochre) and oil-dressed hair. L'Horne, accompanying the de Surville expedition of 1796 remarks that:

They dye their hair with red paint dissolved in oil (I could not ascertain what they extracted it from, or how they extracted it), which at first made me think their hair was red.

(Kelly 1967)

The deliberate painting of combs with kokowai is suggested also, as some composite combs have heavy kokowai staining under the now decayed bindings. Several of the Kauri Point combs show signs that the frames were deliberately painted with pigment (Holdaway 1984: 179). Kokowai may also have been rubbed into the combs before they were disposed of in caves (Fisher 1962). The oils for dressing the hair came from a variety of sources. Best (1977: 56) documents the use of fine quality oil expressed from the berries of the titoki. The oil was kept in small gourd vessels with leaves of *Olearia* sp. for fragrance. Or as observed by Joseph Banks:

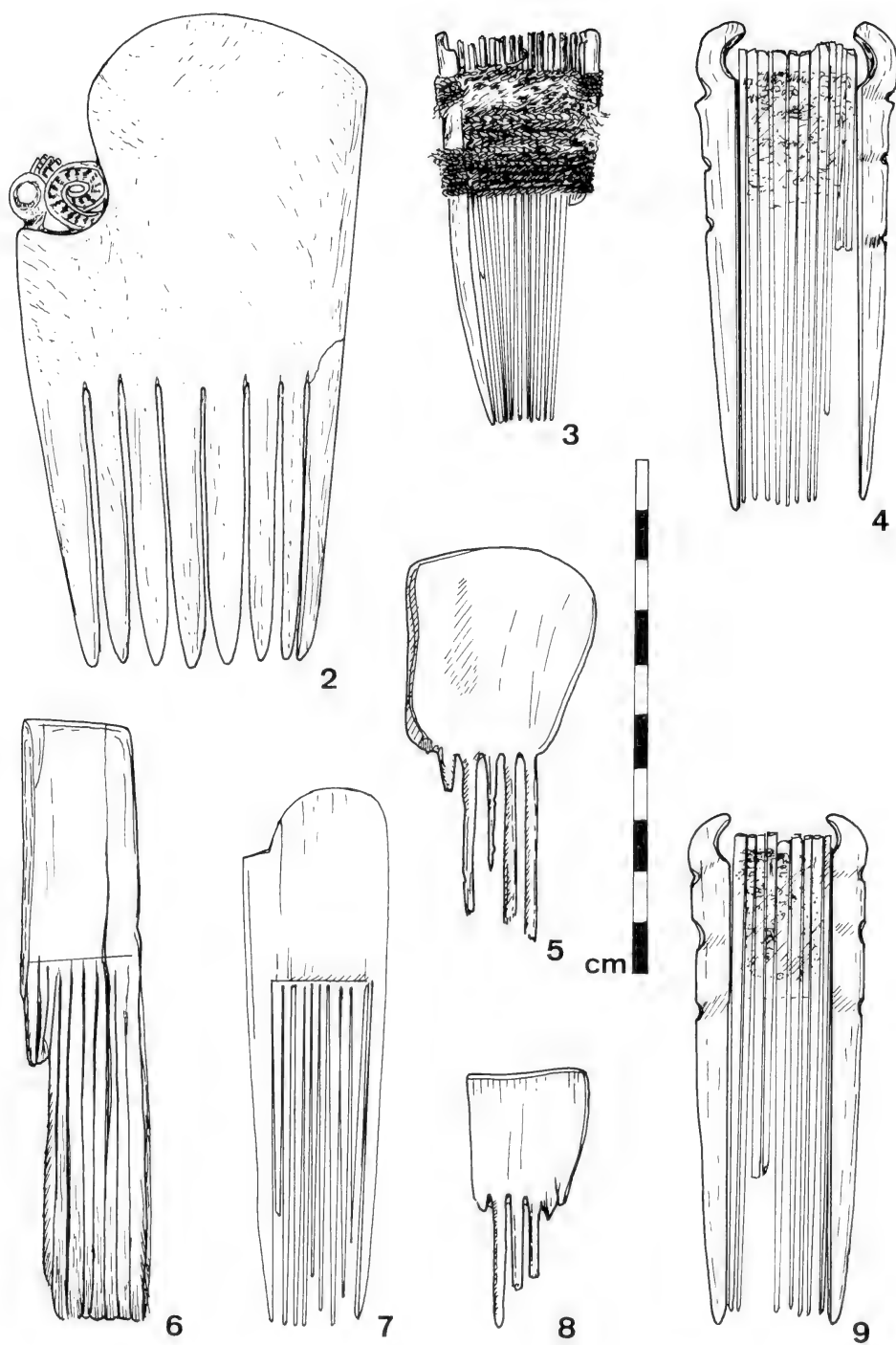
...but the most disgusting thing about them is the oil with which they daub their hair, this is melted either from the fat of fish or birds....

(Morrell 1958)

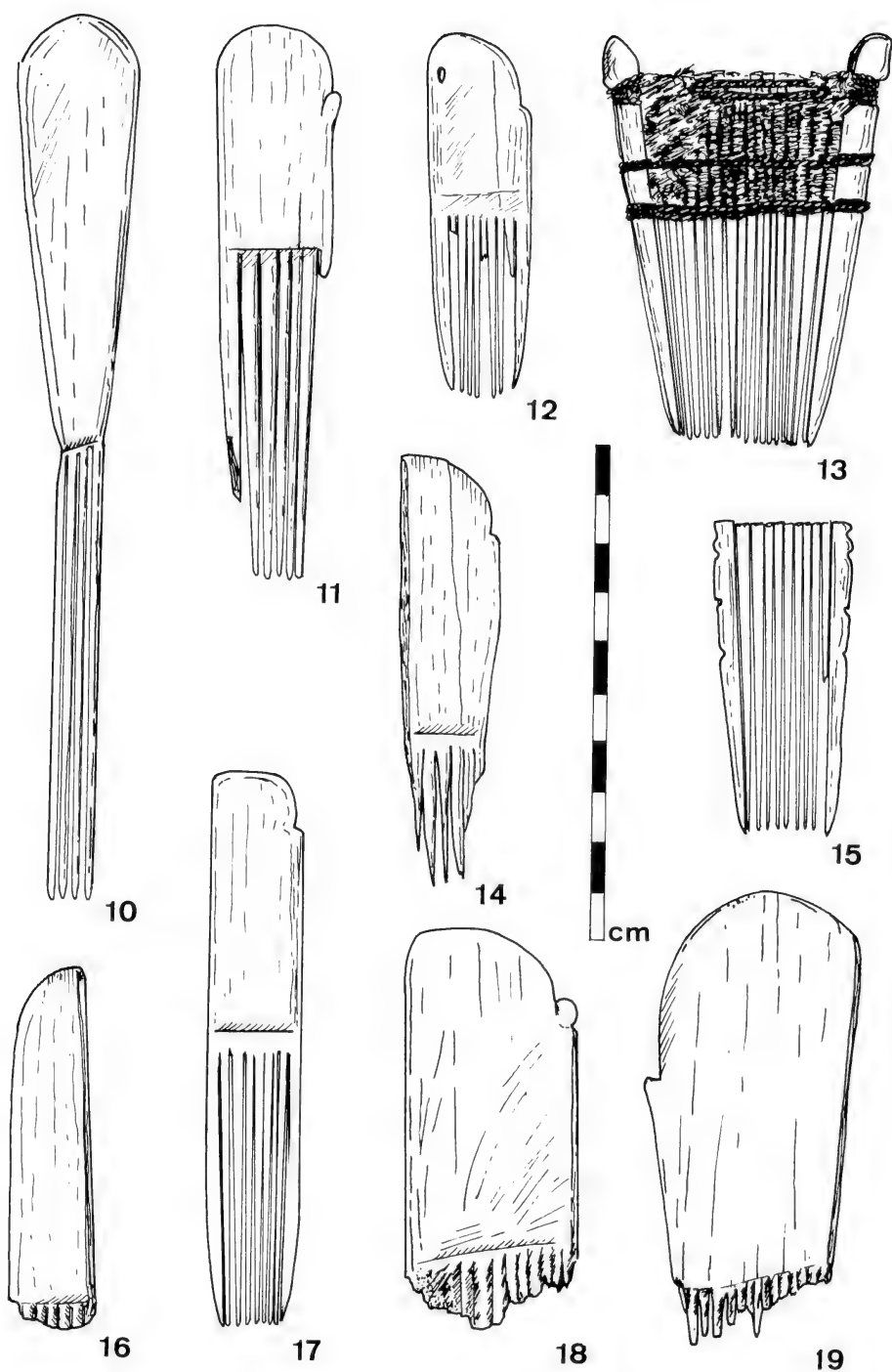
Angas documents the use of both titoki oil and shark oil:

Wooden combs, of small size, but very neatly made, were formerly used by the men for fastening up the hair into a knot at the crown of the head; but these now are becoming obsolete. Oil is employed in beautifying the hair: two sorts of this substance are in use among them; one expressed from the seeds of a tree called *titoki*, the other obtained from shark.

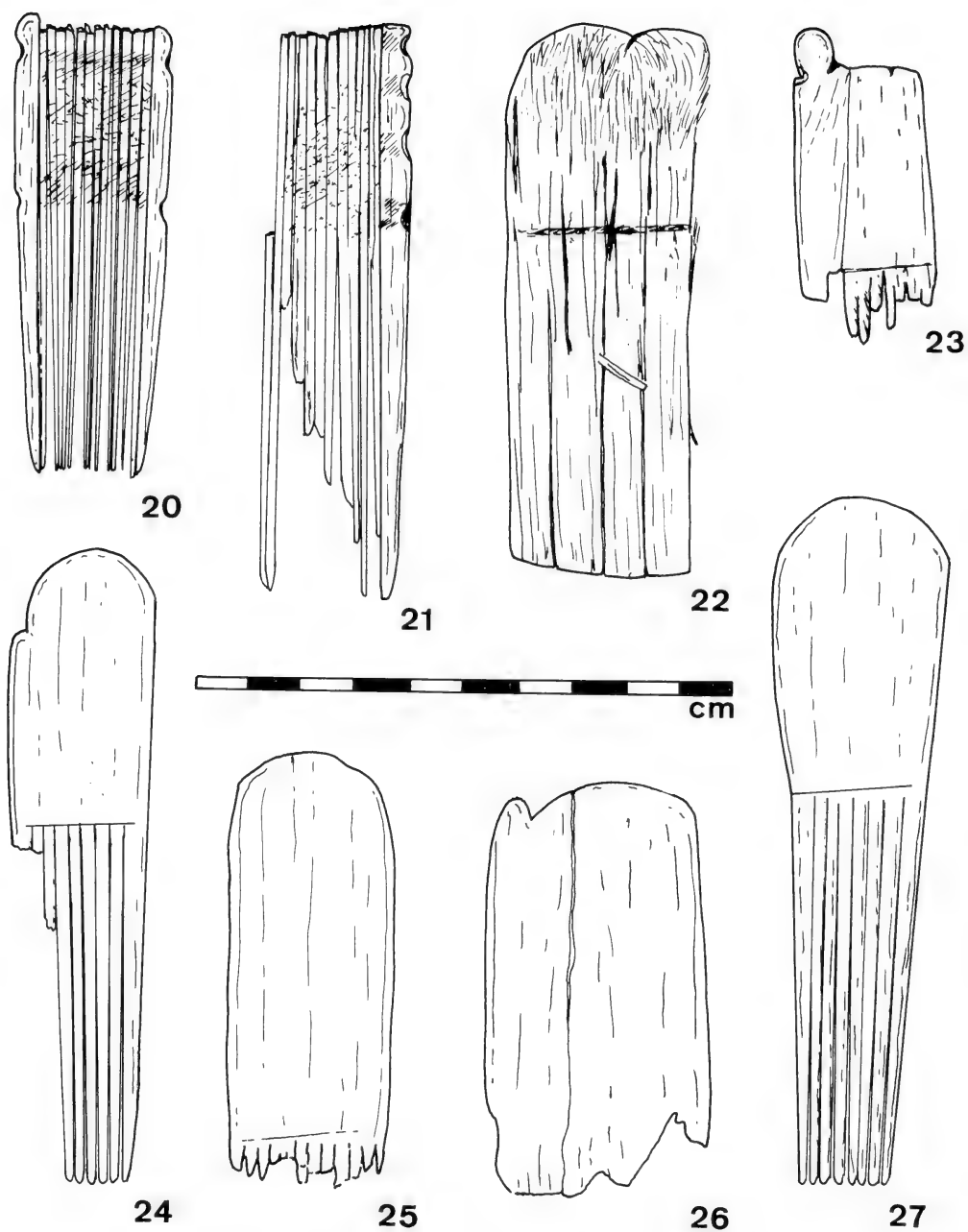
(Angas 1847)



Figs. 2-9. Combs. Waitakere Ranges. 2. 2598 Anawhata. 3. 23879 Anawhata. 4. 23878 Anawhata. 5. 31756 Anawhata. 6. 23882 Anawhata. 7. 23880 Anawhata. 8. 31757 Anawhata. 9. 23881 Anawhata.



Figs. 10-19. Combs, Waitakere Ranges. 10. 31730 Piha. 11. 19768 Piha/Karekare. 12. 22563 Mercer Bay. 13. 17298 Te Henga. 14. 43133 Paratutae. 15. 17104 Paratutae. 16. 43134 Paratutae. 17. 22276 Paratutae. 18. 22277 Paratutae. 19. 31377 West Coast.



Figs. 20-27. Combs, Waitakere Ranges. 20. ME 13264 Te Ahua Pt. 21. ME 13243 Te Ahua Pt. 22. ME 13244 Te Ahua Pt. 23. ME 13245 Te Ahua Pt. 24. ME 13210 Paratutae. 25. ME 13644 Paratutae. 26. 42140/42139 Whatipu. 27. D 37.7 Paratutae.

All but one of the combs (Fig. 13) were found in shelters and caves from Anawhata south to Paratutae Island. Seven of the eight combs located to Anawhata were collected by Mappin and Pycroft but with no additional information. A further six (Figs. 10, 11, 12, 13, 21) came from the Piha area, mostly from a large shelter between Te Ahua and Takatu Points (N41/229). Paratutae I was an important repository with six one-piece combs and one composite comb coming from rock shelters there. This distribution pattern may well simply reflect collecting practices rather than actual distribution as many of the combs were found either by Mappin and Pycroft or E. Willis.

Bone comb

The decorative bone comb is included in Duff's list of ornaments of the late prehistoric period and is presumed to be a later feature of Maori culture (Duff 1956; Skinner 1930; Buck 1950). The bone comb (*heru iwi*) illustrated (Fig. 2) is of whale bone and is similar in size, shape and decoration, having a curved top and finely crafted spiral decoration, to one figured from Oruarangi (Fisher 1934: 278). Skinner (1930: 285) has suggested that the use of bone for combs is a late development which was at a peak when Cook arrived in New Zealand and that the wooden comb has been made from the time of earliest settlement. Nicholas describes:

He had a handsome mat adorned with feathers tied around his waist, leaving bare the upper part of his body, which was deeply besmeared with oil and red ochre; his hair was nicely tied up on the crown of his head, and a large comb as white as ivory, made of the bone of some cetaceous animal, and curiously cut in filigree work, stuck in it. His cheeks were painted red, which giving fire and vivacity to his eyes, formed a curious and not unbecoming contrast to his black and bushy beard.

(Nicholas 1817: 98)

One-piece wooden combs

In general the Waitakere one-piece combs taper slightly throughout their length and are well made and carefully finished. The method of manufacture is unknown but they may have been crafted with obsidian, fine files and chisels or even, as suggested by Shawcross (1970), with hafted rat's incisors! There is a possibility that stingray spines may have been used as fine saws for separating the teeth of the combs and several unmodified stingray spines have been found in shelters. When compared with combs from other major collections from the Bay of Plenty archaeological sites, Kauri Point and Kohika (Shawcross 1964; Irwin 1975; Boileau 1978), the Waitakere combs are generally smaller with fewer teeth (Table 1).

Not only are the Waitakere combs smaller than those from the Kauri Point swamp, but many of the combs have heavier outside framing teeth which are present in the Kohika combs, but lacking in the Kauri Point ones. Combs without framing teeth in the Waitakere collection include two fragments (Figs. 5, 8) which appear different in other respects. The well-spaced teeth are rounded in section and the frames are rectangular (Fig. 8) or only slightly rounded (Fig. 5). Shawcross (1964), in his stylistic analysis of combs from Kauri Point, found that rectangular shaped (Type B)

Table 1. Comparisons of combs from West Auckland and Bay of Plenty.

	West Auckland Waitakere Ranges	Bay of Plenty Kauri Point (N53-54/5)	Kohika N68/140)
Number of combs	26	187	6
Average tooth length	6.4 cm (3.6-9.1)	7.8 cm (5-11)	8.3 cm 7.4-10.7)
Average frame length	5.4 cm (2.4-8.6)	6.3 cm (3-13)	10.2 cm (5.2-15.0)
Average frame width	2.5 cm (1.2-4.0)	4.4 cm (2-7)	4.3 cm (3.9-5)
Average frame thickness	0.4 cm (0.3-0.7)	0.4 cm (0.3-0.6)	0.4 cm (0.3-0.5)
Average tooth rate per comb	9	13	15
Wood type	mostly mapara	mapara	mapara

comb frames occurred in greater numbers earlier in the sequence, with the earliest dates of comb deposition in the swamp being about A.D. 1500 (Shawcross 1964, 1970; Green 1978). It is possible that these two examples (Figs. 5,8) may be of earlier date than the other combs, which are round topped, either completely plain or with knobs cut out of the original profile. Shawcross (1964) has identified these as being a relatively late form. He bases this on relative frequencies in the sequence and the fact that they are similar, if slightly less ornate, to those collected on Captain Cook's first voyage in A.D. 1769 and illustrated by Sydney Parkinson. Green (1978: 39) suggests that the deposition of combs at Kauri Point commenced about A.D. 1500 and continued for about 200 years, ending before the 18th century.

There is relative lack of ornamentation on the Waitakere combs in contrast to that found on the earliest ethnographic specimens, however a wooden comb figured by Kaeppler (1978: fig. 335) collected on one of Cook's voyages is very similar to the Fig. 7 example from Anawhata. Sydney Parkinson's drawings may have concentrated on Maoris of high status and consequently their ornaments would be more elaborate than those of the general population.

One-piece combs are not known archaeologically or ethnographically from eastern Polynesia. According to Hosking & Leahy (1982: 96) it is likely that such combs were an indigenous development in New Zealand.

Composite combs

There are seven composite combs in the collection. Composite combs consist of a number of carefully shaped wooden teeth tapering throughout their length to slender rounded ends. Heavier outer framing teeth are notched to help secure the binding cords. The bindings are finely plyed flax cord and the weaving technique in the case of the two complete Waitakere examples is single-pair twining (Fig. 3) and a mixture

of single-pair twining to attach the frame to the inner teeth and a simple plain weave to bind the teeth (Fig. 13). Examples of composite combs with completely decayed lashings (Figs. 4,9,15,20,21) show heavy kokowai staining and many small fragments of fibre adhering to the inner teeth. This may indicate that an adhesive gum was used to help bind the lashing to the teeth.

Archaeologically, elements from composite combs are rare. A rock shelter, Waihora Bay, Taupo (N93/5) (Hosking & Leahy 1982) contained comb fragments of bone and composite wooden combs, kokowai stained, with partly intact lashings. Fine composite combs are included in museum collections and are illustrated and represented in collections from Cook's voyages (Kaepler 1978). A series of Maori heads (Fig. 28) illustrated by Parkinson (1784) show a possible composite comb on the upper right head. The other combs are of wood with exaggerated knobs. The composite comb is known in West Polynesia ethnographically, but according to Davidson (1984: 87) it is likely to have been a widespread form which died out in other parts of East Polynesia.

For cultural reasons, this image has been removed.
Please contact Auckland Museum for more information.

Fig. 28. Top knot styles and combs (from Parkinson 1784).

DISCUSSION

Stylistically most of the combs found in the Waitakere Ranges are simple and unornamented and appear to be the "everyday" ornaments of ordinary people. A wooden comb collected on one of Captain Cook's voyages is of similar form to some of the Waitakere combs indicating that this simple style was in use at the time of European contact. Similarly, the whalebone comb is a typical hair decoration of the contact period (Skinner 1930). Carbon-dating of shell from shelters and other prehistoric sites along the west coast supports a 16th-17th century period of peak population of the Kawerau tribe, with pa constructed to provide defense against sporadic and repeated raiding from the north (Hayward & Diamond 1980). Many of the rock shelters contained artefacts of wood, bone, shell, fibre, midden and fire stones indicating at least temporary occupation. The Kawerau population declined dramatically after the 17th century through repeated warfare and introduced diseases (Taua 1987). Following this decline in permanent population some of the shelters were used as burial sites and repositories for such tapu objects as cut hair and combs.

The possible lateness of some of this deposition and the tapu nature of these combs, the dryness of the caves and the early retrieval of the artefacts by responsible collectors accounts for the excellent state of preservation of this large collection of combs.

Acknowledgements. I am most grateful for the help freely given by the following people. Ann Leahy of Auckland shared with me her research on combs, Rod Wallace of The University of Auckland identified wood species, and Janet Davidson helped with the Willis collection in the National Museum, Wellington.

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ARCHAEOLOGICAL EXCAVATIONS AT RAUPA: THE 1987 SEASON

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Abstract. Excavations at Raupa, near Paeroa, were undertaken to salvage some information before the site was destroyed in the course of flood control work by the Hauraki Catchment Board. The first of two seasons work in 1987 and 1988 is reported here. Raupa is a swamp pa of the Hauraki Plains. It is similar in location and environment to Oruarangi, a site which has been important in New Zealand archaeology because of the great number of artefacts found there and the use of resulting collections in describing the material culture of the 'classic Maori'.

The 1987 excavations were directed to outlining the internal arrangement of the Raupa settlement and locating one of the large houses described by the Rev. Samuel Marsden during his visit of June 1820. A large house was found along with cooking and waste disposal areas, a rectangular storage pit and a variety of fences, stockades and roofed structures. Obsidian and chert was abundant, artefacts included adzes and adze pieces, kokowai grinding stones, patu muka and patu onewa pieces, a pumice pot and bone needle, also fishhook, bird spear and tattoo chisel fragments. A hoanga fragment was incised with a simple design reminiscent of facial tattoo.

In January and February 1987 and again in early 1988 archaeological excavations were carried out at Raupa (T13/13, formerly N53/37) on the left bank of the Ohinemuri River near Paeroa (Fig. 1). The site is one of a small group of pa, or defended settlements, which occupied low lying riverbank ground isolated and protected within the formerly vast and encompassing swamp of the Hauraki Plains. Among similar sites is Oruarangi which is of importance in New Zealand archaeology for the great variety and abundance of artefacts found there, and for the conclusions drawn from this assemblage regarding the nature of 'classic Maori' material culture (Golson 1959; Green 1963:77-81).

Excavations at Raupa were undertaken partly to investigate the nature of that particular site and partly also to learn more about Hauraki Plains swamp pa as a whole. The results of the first season's work, 12 January — 21 February 1987, are reported here.

History

Little is known of the history of Raupa. Kelly (1945:210) reports a traditional account of Te Kahureremoa who spent a night at Raupa, "as early as A.D. 1600". The settlement at the junction of the Waihou and Ohinemuri River comes suddenly into

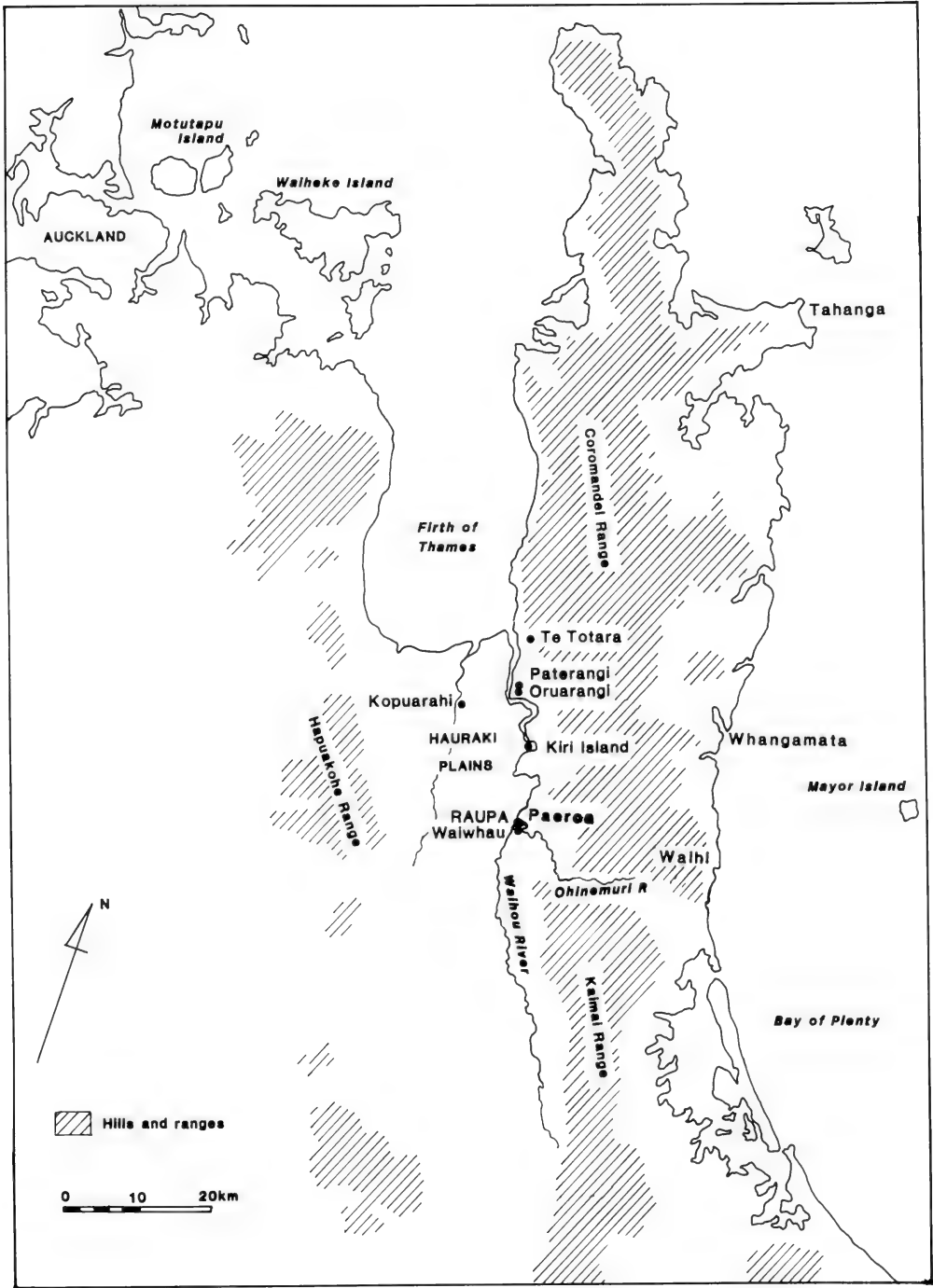


Fig. 1. Location map.

the glare of recorded history when Samuel Marsden visited in the winter of 1820 in the course of one of his missionary journeys in the northern North Island.

Marsden's invaluable record helped direct the 1987-88 excavations and played an important role in interpretation. The relevant part is given here in full.

"June 17th. — The following morning we proceeded up the river in the launch with a fair wind and tide. The two chiefs accompanied us and about fifty of their people in canoes. Mr. Hume, the surgeon of the *Coromandel*, the carpenter, and the captain's clerk were also of the party. We had a very fine day, and arrived in the evening at a settlement called Kowpah, situated at the junction of two fresh-water rivers whose united streams form the Thames.

On a point of high land where the two streams meet, and by which it is surrounded, stands the hippah of the head chief or areekee (*ariki*) as the natives call him. The hippah was very full of people, who welcomed us on shore with loud acclamations and conducted us to the areekee who was seated in the midst of his family. He was an old man, apparently not far from seventy years of age, well made and of great muscular strength. His mother was still alive with three generations by her. The natives' houses here were much larger and better built than any I had seen in New Zealand. The areekee appropriated one for us, which afforded lodging to us and the fifty natives who had attended the launch up the river."

(Elder 1932:255)

The next day being Sunday Marsden and his party rested.

"On the following morning (Monday, June 19th) Mr. Anderson went to examine the spars in the neighbourhood, and I got a canoe with some natives and proceeded up the left river; the land on the banks was very rich, and here and there adorned with lofty pines; some small farms were cultivated for potatoes, upon which the poor slaves were at work.

The tide runs a few miles up this river, and when we had proceeded about ten or twelve miles, in which space the water was close confined by thick wood on high banks, it opened into a plain and became shallow, and, as night was coming on, I returned to the hippah."

(Elder 1932:256)

Raupa was a pa of the Ngati Tamatera tribe. At the time of Marsden's visit the countryside was unsettled by threats from the Nga Puhi and their allies and Raupa may also have provided a refuge for sections of other Hauraki tribes as well. The Ngati Tamatera chief at the fortified settlement in 1820 was Te Hikamate (Kelly 1945:207). The two chiefs who accompanied Marsden up the river were Te Puhi of Te Totara (near Thames) and the Ngati Whanaunga chief Te Horeta.

Only 18 months after Marsden's visit Te Totara was taken with great loss of life by Nga Puhi from the Bay of Islands district. Shortly afterwards the northern tribe pushed up the Waihou River and a fight is said to have taken place at Raupa. "Maeae and Toea, chiefs of Ngapuhi were killed. Ngapuhi fled" (Rihitoto 1893:111). In November 1833, the missionary Henry Williams called at the old pa and noted that there was, "No one here, nor any fences up to indicate a Fortress" (Rogers 1961:346), suggesting that there was nonetheless a settlement, unoccupied at the time, which would have required defences if the district was as unsettled as formerly.

Environment

Raupa occupied a narrow point of land at the confluence of the Waihou and Ohinemuri Rivers near the eastern margin of the Hauraki Plains (Fig. 1). The plains extend approximately 40 km north-south and as much as 25 km east-west. Close to the west and east margins the Piako and Waihou Rivers meander slowly to the sea. The Waihou is joined by several major tributaries flowing from the Coromandel and Kaimai ranges to the east. Notable among these is the Ohinemuri which drains an extensive basin east of the ranges before cutting through by way of the narrow Karangahake Gorge then winding its way across the Hauraki Plains to join the Waihou.

The two rivers no longer meet at the Raupa site. Early this century the Waihou was straightened by way of a canal to cut off the bend which formerly looped eastward to the old confluence with the Ohinemuri. Today, only the Ohinemuri flows past the site, joining the larger river some 2.5 km downstream. The old Waihou channel is marked by willows and occasional shallow ponds as it wanders over farm land west of the Raupa site.

The Hauraki Plains even today are not fully drained. Low lying and subject to flood and tidal influence the plain was formerly a vast swamp of raupo, flax, and stands of tall kahikatea. The latter were probably concentrated on natural levees which flanked the major rivers. An 1884 map (Anon. 1884) which includes the Waihou-Ohinemuri junction shows a large patch of bush between the two rivers narrowing along the right bank of the Waihou to the south where it is backed by an extensive swamp reaching almost to the foot of the hills which border the plain.

Raupa is approximately 40 km from the sea by the winding course of the river. Even at this distance the tidal flow is considerable and the rise and fall of the river next to the site is as much as 1.5 m.

East of the site some 2.5 km (8-10 km by the Ohinemuri River) rise the foothills of the ranges which bound the west side of the plain. These stand 500 m above sea level in the vicinity of the site and as much as 950 m at Mount Te Aroha 20 km south. Some of this hill country is now cleared of bush for pastoral farming. Most of the remainder has been logged for kauri and other valued timber trees. At the time Raupa was occupied the ranges were covered in forest dominated by kauri, here approaching the southern limit of its range.

The environment of the Raupa site was rich and productive for the Ngati Tamatera people living there. The river brought fish including mullet, kahawai, eels, lamprey and whitebait to the pa. The wetlands of the vast swamp were a rich habitat for duck and other waterbirds. Above the water-table the natural levees and other higher ground provided rich soil for food crops, notably kumara but probably also the newly introduced potato, sweet corn, melon and other vegetables at the time of Marsden's passage in 1820. Harakeke (flax) which was valued for making items from the finest cloaks to the most everyday food baskets and other mundane items, and raupo for thatching and other purposes, were available in great abundance. Timber trees for the construction of houses and pa defences and for fashioning a vast range of objects both aesthetic and utilitarian were available at hand or in the ranges nearby.

In the ranges but not on the wet plain was kauri (*Agathis australis*), perhaps the most valued of all timber for houses, canoes and very many smaller objects. There were also pigeons (*Hemiphaga novaeseelandiae*), tui (*Prosthemadera novaeseelandiae*), kaka (*Nestor meridionalis*), kiwi (*Apteryx* spp.) and other birds hunted in season for food. Also in the hills were stone materials which included obsidian at the nearby Waihi source, chert and kokowai. Necessary oven stones were available from the bed of the Ohinemuri River where it cuts through the ranges, and were easily transported to Raupa by canoe.

Also accessible by canoe was the Firth of Thames with its extensive fishing grounds, and soft and rocky shore shellfish resources. Maori canoe travellers could take advantage of outgoing and incoming tides to get to and from the sea.

Archaeology

Archaeological interest in Raupa might be said to have begun with the surveyor Courtney Kenny from whom we have a sketch plan of remains visible in 1893, published by Kelly in 1945. Kelly himself visited in July 1945 and noted a considerable deterioration of the site since Kenny's time, not helped by the construction of a stopbank across the old pa and an immense quantity of rock-flour from gold mining operations in the Karangahake Gorge which overlay a wide area in this part of the Hauraki Plains (Kelly 1945).

The Raupa site was recorded in the New Zealand Archaeological Association site record scheme in 1963 by Roger Green who located the site from Kelly's article. In the same year it is shown on a map which illustrates a summary article listing Hauraki material culture by Roger and Kaye Green (1963:29).

In 1983 Raupa and the neighbouring site of Waiwhau were relocated by Simon Best in the course of a survey undertaken for the Hauraki Catchment Board as major new stopbank construction and flood control measures were being carried out. Archaeological evidence now took the form of scatters of shell, ovenstones and patches of black soil turned up by motor-scrapers gathering fill for the greatly enlarged stopbank nearby. A large part of what was being taken was rock-flour which overlay the site. At the north end of the old pa, however, the site was cut down as much as 2 m, entirely removing the occupation surfaces and almost reaching the base of three major defensive ditches lined up across the narrow neck of the former river bend (see Fig. 2). Altogether something in excess of half that part of the site which survived the considerable river erosion of the previous 150 years has since been destroyed by river control works.

In addition to the Raupa site itself Best records signs of Maori occupation at the Waiwhau site on the opposite (south) bank of old Waihou River channel (Fig. 2). This site too was severely damaged by earthworks.

Best arranged for machine trenching of both sites, partly for accurate location of intact archaeological deposits and partly for stratigraphic information. The sections revealed in these trenches were subsequently recorded and drawn up by Joan Maingay and Rosemary Taiaroa of the New Zealand Historic Places Trust, Auckland (see Phillips 1986:94).

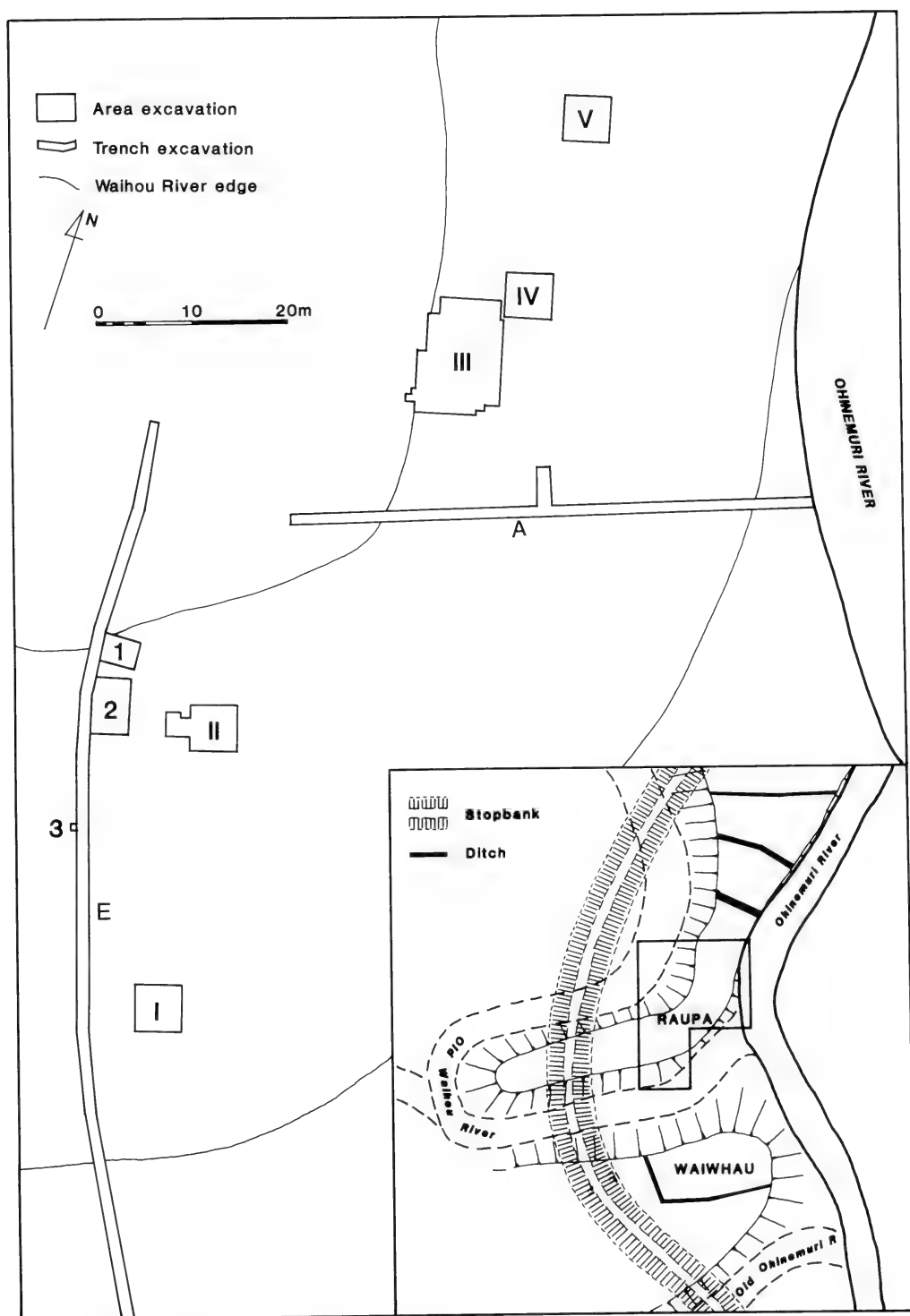


Fig. 2. The Raupa site showing Areas I-V excavated in 1987 and Trenches A and E.

When the Hauraki Catchment Board applied for and received from the Historic Places Trust an authority to destroy the remainder of the two sites an investigation was hurriedly organised to recover some information before the sites were lost. A two week excavation directed by Caroline Phillips took place in February 1984 (Phillips 1986). It was understood that the sites would soon after be destroyed by the Catchment Board works.

The 1984 strategy involved further machine trenching and limited hand excavation to gain as much information as possible regarding the extent and stratigraphy of both sites and the location and nature of the defensive ditches at the north end of Raupa, and to identify internal structures and activity areas (Phillips 1986:89). The invaluable results of the work were quickly published and have acted as a fundamental resource for the present work.

Two years after the 1984 excavations it became clear that progress on Catchment Board work was slower than had been anticipated. The opportunity therefore arose for further work on the Raupa and Waiwhau sites, to build on the results of 1984, and to ask further questions of the two sites in particular and of the important class of sites which they represent in general.

Excavations at Raupa in 1987 and 1988 were funded by the New Zealand Historic Places Trust with equipment and other support from the Anthropology Department, University of Auckland, and the Auckland Museum. At the same time two shorter excavation seasons were devoted to the neighbouring Waiwhau site by the university Anthropology Department which ran the work as a field school in excavation method for senior students. The 1987 Waiwhau work has been reported separately (Phillips 1988).

The research context

The swamp pa of the eastern Hauraki Plains hold an important place in the study of New Zealand archaeology. From the 1930s to the 1960s collectors dug on these sites, most notably at Oruarangi, attracted by the well known abundance and variety of artefacts. The method was quick and unscientific and it need hardly be said that little was discovered of the history of the sites, or indeed of the collections which were recovered. There were nonetheless some valuable descriptions published of material which found its way into the Auckland Museum (Fisher 1934, 1935, 1936, 1937) and Otago Museum (Teviotdale & Skinner 1947) respectively, the latter also including a brief discussion of archaeological context.

More importantly, the considerable Oruarangi collection was basic to Golson's 1959 definition of 'classic Maori' material culture. From the published museum collections Golson listed Oruarangi patu, fishhooks, ornaments, musical instruments and other items which he argued to be characteristic of classic Maori as a whole. Four years later Green argued for the importance of Hauraki Plains material as "... one of the best documented regional collections ever assembled for North Island aspects of the Classic and Early European Maori phases" (Green 1963:79). He went on to suggest a cultural sequence for which casual finds and excavations alike point strongly to

relatively late settlement of the wet and lowlying plains. In the same year Green & Green (1963) presented a valuable list of finds for the Oruarangi, Paterangi, Kiri Island and Kopuarahi swamp pa (Fig. 1).

Green & Green (1963:29-30) also gave a brief account of stratigraphy at Oruarangi as revealed by test excavations carried out by Golson in the mid-1950s. Shawcross & Terrell (1966) reported their test trenches at the neighbouring Paterangi site but remained pessimistic on the prospect of providing a satisfactory context or sequence for artefact collections from the Hauraki Plains sites. They also expressed concern that uncontrolled collections from the Oruarangi site which may have been occupied for as much as 300 years were used by Golson to define a "Classic Maori Phase" (Shawcross & Terrell 1966:408).

In 1980 Best published a major review of work done on the Oruarangi site and collections. Test excavations were carried out at Oruarangi and Paterangi. A date of 450 ± 80 B.P. was obtained from charcoal recovered from Oruarangi to suggest an initial occupation in the 15th or 16th century (S. Best 1980:73). A survey of the lower Waihou River area put the site into its geographic and settlement pattern context.

The 1984 excavations at Raupa and Waiwhau obtained useful results, especially concerning the extent of the sites, their general stratigraphy and similarities with Oruarangi and other Hauraki sites both in stratigraphy and artefact finds (Phillips 1986). Phillips argued that a central area of Raupa may have been artificially raised by shell deposits in much the same way as Nichol (1980) has demonstrated for Oruarangi. Evidence for built wooden structures was found as well as a possible bell-shaped storage pit (Phillips 1986:102, 104).

It is impossible to escape the shadow of Oruarangi when working on swamp pa in the Hauraki Plains, and indeed the many unanswered questions about that site provided major research objectives for the 1987-88 Raupa excavations. In the first instance it was hoped to recover sufficient artefacts from secure archaeological contexts at Raupa to help make sense of the Oruarangi and other Hauraki Plains assemblages. Secondly, the lack of information from these sites on internal settlement organisation, dwellings, food storage and other structures needed to be redressed. Thirdly, any addition to economic information must be useful as little has been published from the Hauraki sites on this present central concern of New Zealand archaeology, probably because the enormous artefact collections have been of such compelling interest.

As well as general questions of Hauraki Plains swamp pa as a whole, Raupa also has particular interest. Marsden's record of houses, "... much larger and better built than any I had seen in New Zealand" (Elder 1932:255) pointed to the prospect of important architectural information. The antiquity of settlement at the Waihou-Ohinemuri junction and the archaeological manifestation of early European contact in the region should also be of interest. Raupa is a large site of approximately two hectares which Marsden's journal shows to have been a major settlement in the early 19th century: it deserves interpretation on its own account and not simply to make sense of other sites and collections however important.

THE 1987 EXCAVATION

Much of the Raupa site has already been lost to natural erosion or river control earthworks so that large parts of the former settlement are no longer open to investigation. What remains, however, includes the central part of the old pa which might be expected to be as important historically and complex archaeologically as any part of the site. A particular objective of the 1987 work was the location of one or more of the large houses which so impressed Marsden. These would have been important in the social and economic life of the settlement and are thus likely to have been located in the central part of the pa, the very part now available for excavation.

Work began with the stripping of rock flour and other over-burden from selected parts of the site by grader. Excavation areas were then laid out on a compass bearing of 345° which was roughly aligned to the long Trench E dug through the south-west end of the surviving site in 1984 (Phillips 1986:101). Areas I and II were opened up just east of Trench E and Areas III and IV north of the transverse 1983 Trench A (see Fig. 2). None of the excavated areas was marked by any surface indication of what might lie beneath. In the following account of the excavation the stratigraphy, occupational sequence, structural features, midden, artefactual finds and waste stone material are described in turn for each of the five excavated areas.

The excavation strategy was aimed initially at finding out as much as possible about the arrangement of settlement across the site. Four exploratory squares of 5 x 5 m (Areas I — IV) were opened up to examine different parts of the site with a fifth (Area V) begun later. The 25 m² areas it was hoped would be large enough to allow interpretation of any buildings or other structures found and would direct the extension of one or more of the squares as seemed fruitful. In the event a total of 213.35 m² was excavated although not everywhere was the bottom of the site reached.

AREA I (Figs. 2,3-11)

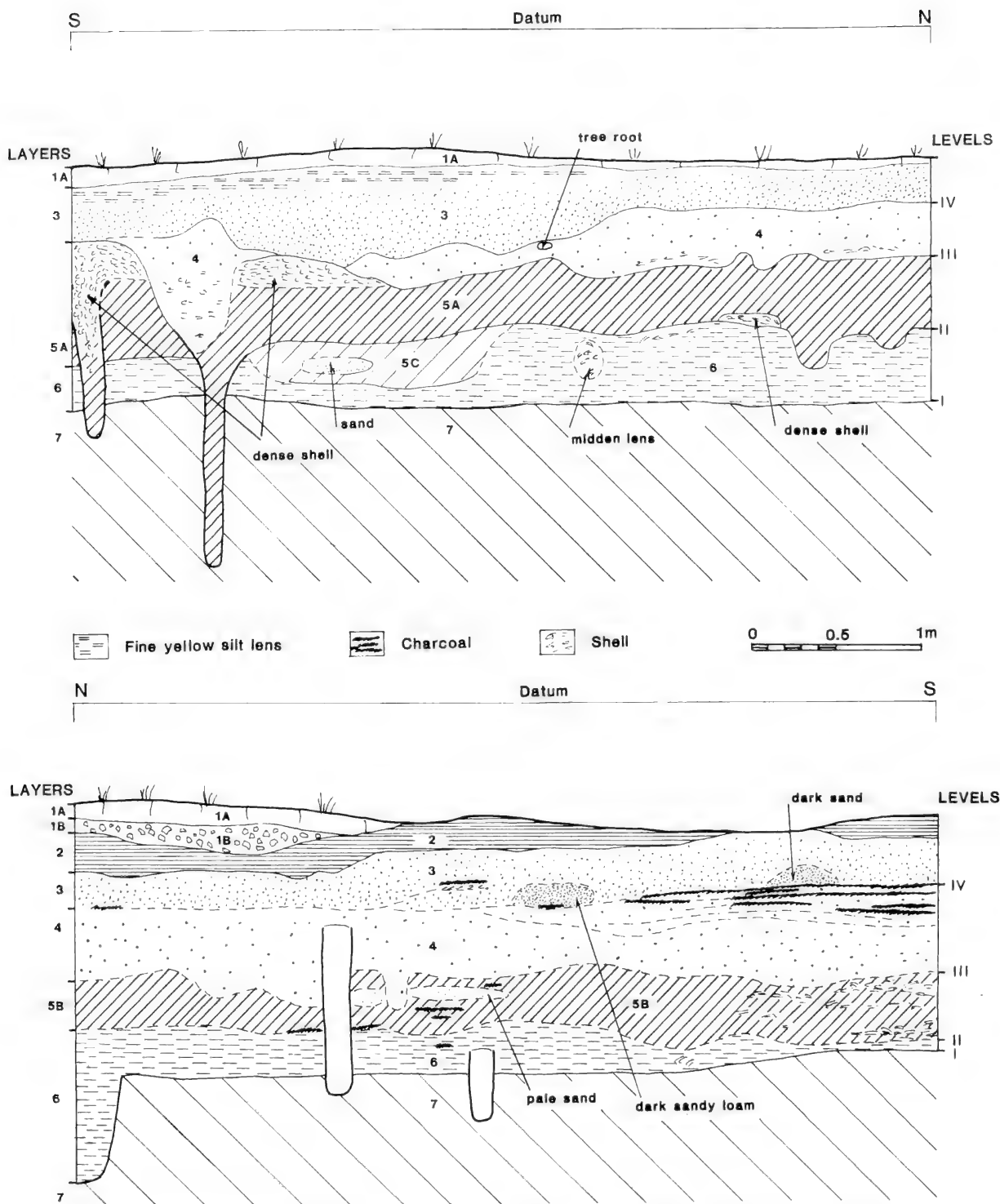
Area I was located at the south-west corner of the site, *ca.* 10 m from the former Waihou River channel and 5 m from Trench E (Fig. 2). Black soil and a considerable shell lens revealed by the nearby trench (see Phillips 1986: Fig. 10) suggested this part of the site may have been used for cooking and waste disposal. It was likely also that the area would prove to have deeper archaeological deposits than elsewhere as here the ground dips away to the old river channel which confines the site.

Stratigraphy

Archaeological deposits in Area I were 700-800 mm deep. Six layers were identified along with many minor lenses of material (Figs. 3,4). Four major occupation episodes were identified. Stratigraphic layers were as follows.

Layer 1A. Surface mixed and redeposited silt and rock flour.

Layer 1B. Blue-grey clay rubble from access road put across the Raupa site to assist the 1980 Catchment Board work (see Phillips 1986:98-99, 102). North-east corner of square only.



Figs. 3,4. Area I stratigraphical sections. 3. West section (above). 4 East section (below).
Layer descriptions in text.

- Layer 2. Compacted yellow rock flour from goldmining quartz crushing operations in Karangahake Gorge, late 19th-early 20th century. No more than 100 mm deep. East part of square only. Over the west side it had been entirely taken off, probably during the wholesale removal of overlying silt for stop bank fill in 1980.
- Layer 3. Yellow-brown silt and sandy clay loam, 50-300 mm deep, including some fine silt lenses near the top at the west side of the square (Fig. 3).
- Layer 4. Sandy loam. This layer was variable in colour: predominantly grey-brown at the west side of the excavated square and yellow-brown to the east. The colour variation depends partly upon the presence or absence of very dense black shell midden immediately beneath. At the south-east corner three narrow charcoal bands separated by thin sand lenses were clearly water-laid (Fig. 4). After the abandonment of the Raupa settlement a tree grew on the north-west quarter of Area I. Its root system broke up and raised the midden deposit (Layer 5A), and when it died its decayed roots left holes and tunnels in Layers 4 and 5 in this part of the square.
- Layer 5A. Midden in black sandy silt matrix, as much as 300 mm deep. In places the predominantly shell midden is densely packed indicating primary deposition, elsewhere it is crushed and thoroughly mixed with the black sandy soil. Charcoal is common.
- Layer 5B. At the east side of the square Layer 5 was present, not as a dense midden layer but as a black sandy layer with some distinctive lenses of charcoal and shell at the south end of the section (Fig. 4,6).
- Layer 6. Yellow-brown sandy or silty clay with plentiful charcoal especially at the west side of the excavated area; scattered shell and sand lenses in places.
- Layer 7. Yellow-brown silty clay loam; the unmodified base of the site.

The occupation sequence

Four major occupation episodes are represented in Area I. Many lenses and thin laminations in some parts of the square represent particular events and the passage of time.

Level I. The first occupation is represented by a scatter of post and stake holes found in the two 5 x 1 m strips excavated at the east and west sides of the area (Figs. 7,8). The excavated areas are too small to reveal any pattern except that there is a concentration of small stake holes at both sides of the Area I square. These are distinguished by small circumference, relatively shallow depth and often by a pointed base to the surviving stake hole. There is a suggestion at the south end of the east strip that some of these holes line up with the much more apparent structures of Level II (see Figs. 7,9). Only one posthole contained wood fragments: in this instance identified as kauri.

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Fig. 5. Area I. West section, 13 February 1987.

Fig. 6. Area I. East section, 19 February 1987.

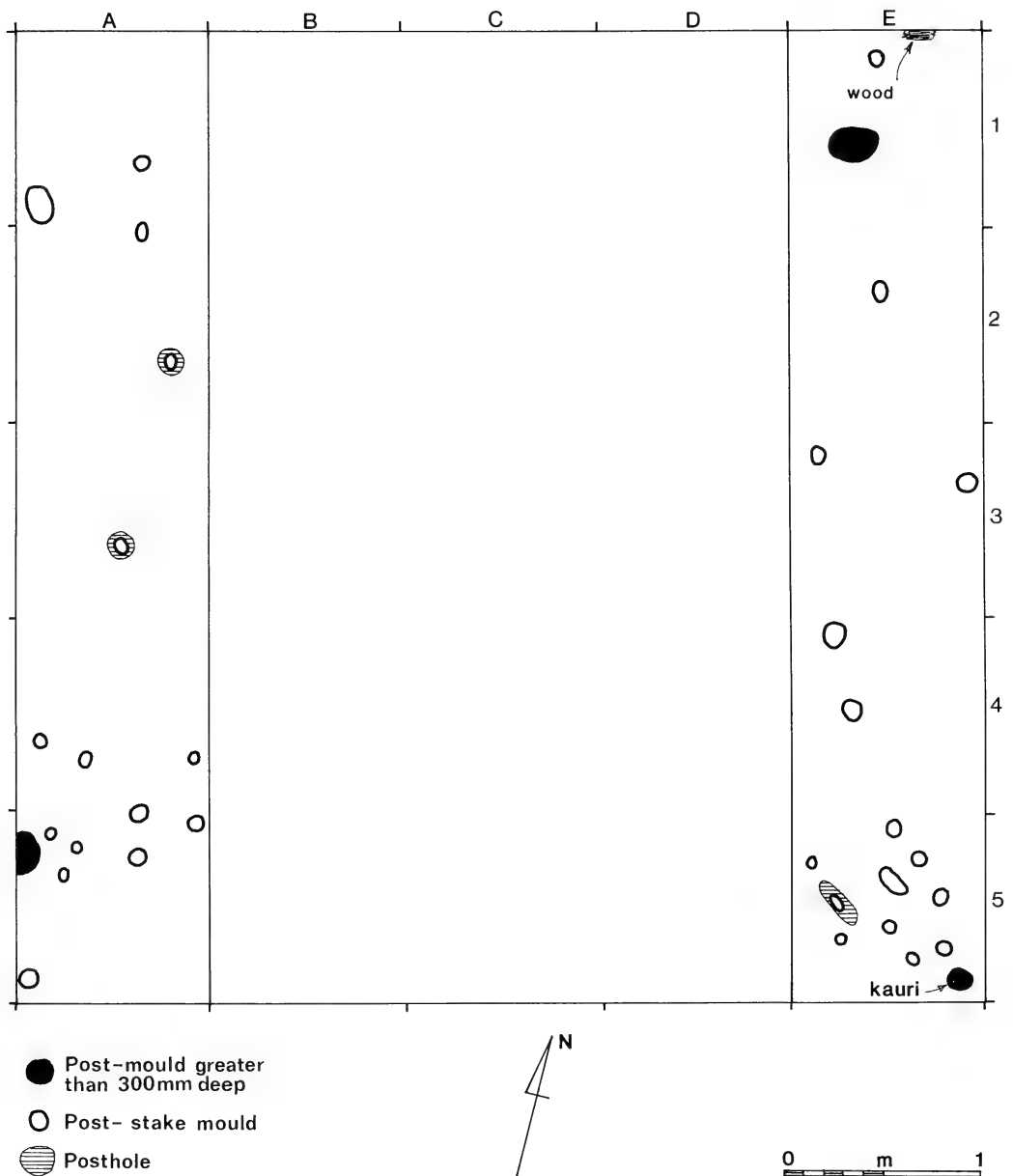


Fig. 7. Area I. Level I plan.

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Fig. 8. Area I. Level I, 13 February 1987. View to north.

Level II. Approximately 90 post and stake holes in the Level II surface (Figs. 9,10) indicate a number of wooden structures, probably including some demolition and replacement over the occupation period. At the south-west part of the square close-set lines of large post-holes suggest a strongly built rectangular structure. This is highly visible in Fig. 9 where postholes of greater than 300 mm depth are emphasised. There is more than one explanation for this pattern. The postholes may mark a roofed structure, much or most of which lies outside Area I to the south-west, or they may relate to the line of post and stake holes and shallow trenches which extends across the square to exit at the north-west corner.

The rectangular structure includes three matai (*Prumnopitys taxifolia*) posts (Fig. 9) in holes of (north to south) 300 mm, 500 mm and 550 mm depth respectively. Clearly there was a very strong structure here. Extending north-west/south-east are two lines of deep postholes and one or two lines of stake holes. There was some use of matai in the Area III house (discussed below), although kauri was the predominant building timber. The lack of kauri in Area I does suggest that it is not a dwelling that is represented here. Added to this is the conspicuous lack of obsidian and other stone material which so often marks the floor of Maori dwellings.

A line of shallow depressions and postholes extends through the rectangular structure to the north-west corner of the square. This offers an explanation alternative to there having been a roofed building here. If the line represents a fence or light palisade it may have been straddled at this point by a lookout or fighting platform set on matai posts a few metres from the bank of the Waihou River.

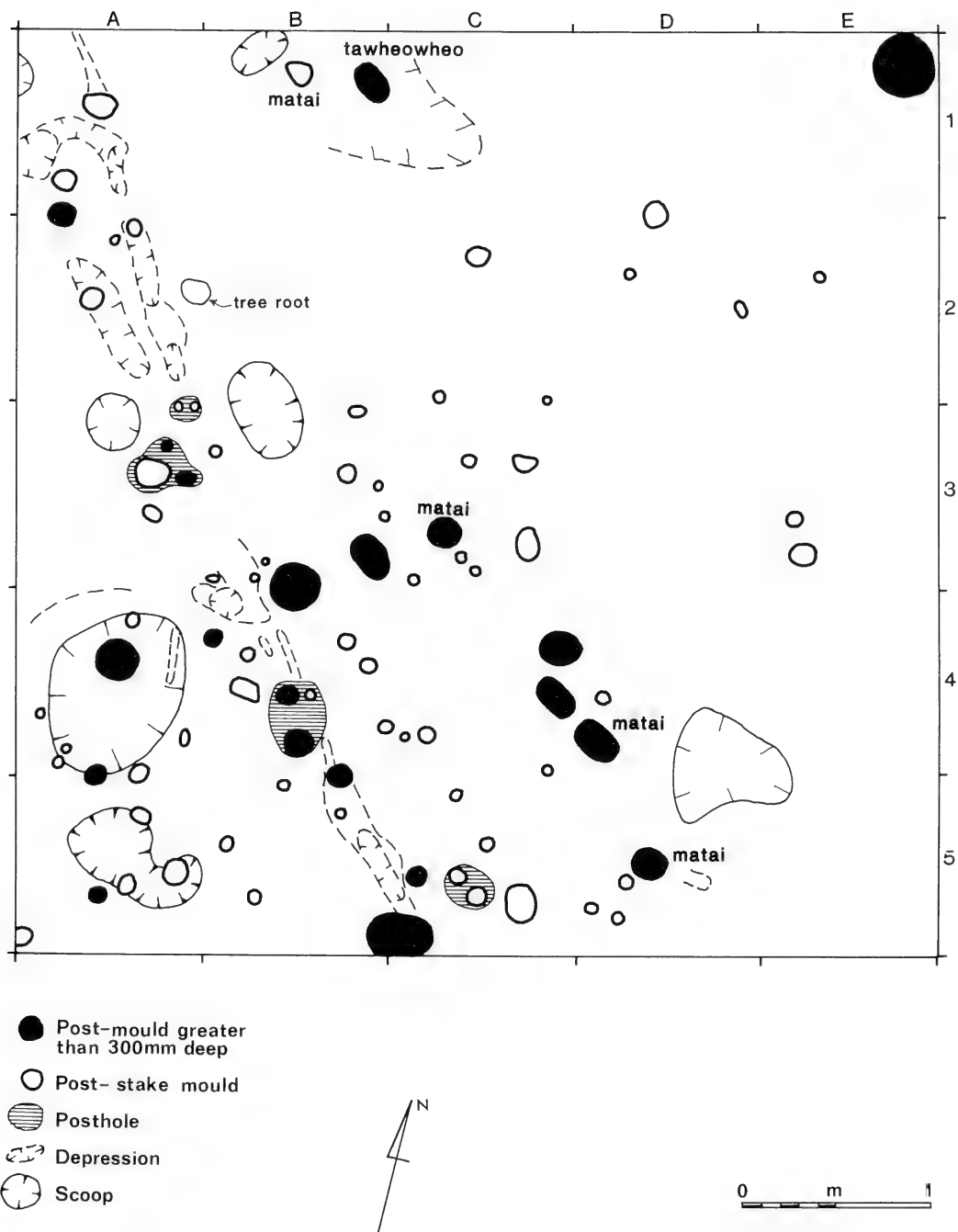


Fig. 9. Area I. Level II plan.

A massive posthole 450 mm deep at the north-east corner of the square probably relates to more outside. Between this post and the large number which fill the west half of Area I is a gap of some three metres which may indicate a passage from the riverbank into the settlement, or simply an unbuilt area or open ground. The posthole with tawheowheo (*Quintinia serrata*) timber in it near the north baulk is 440 mm in depth and is thus deep set for strength. The adjacent matai post is set 290 mm in the ground and may be part of the same structure.

Level III. The third occupation period at Area I is represented by the Layer 5A midden and associated Layer 5B (Fig. 11). This was as much as 300 mm deep at the west (Figs. 3,5) but dips to the east, virtually disappearing halfway across the 5 m square where it is represented stratigraphically by Layer 5B (see Fig. 8). In Layer 5B at the east side of the excavated area some scattered shell visible at the south end of the section is part of the debris of the Layer 5 occupation. There were two or three isolated postholes on the surface (Fig. 11).

The Layer 4 midden was predominantly shell, the shell itself being at least 90% pipi (*Paphies australis*). Cockle (*Chione stutchburyi*) made up the bulk of the remaining 10%, with mussel (*Perna canaliculus*), scallop (*Pecten novaezelandiae*), *Dosinia anus*, *Thais orbita*, *Cominella adspersa*, *Umbonium zelandicum* and a possible *Rissoa miniscula* also present. Most shell was very fragmentary to indicate repeated shifting before being finally dumped. There were, however, some deposits of intact shell, including bivalves with the two parts still attached. Layer 5 thus appears to have been the result of repeated re-use of a nearby cooking area with old and new waste dumped together.

Fish bone in the midden could be accounted for by only a very few individual fish. Included are a minimum number of nine snapper (*Chrysophrys auratus*), two kahawai (*Arripis trutta*), and one each of gurnard (*Chelidonichthys kumu*), john dory (*Zeus faber*), blue mackerel (*Scomber australasicus*) and trevally (*Pseudocaranx georgianus*). A handful of mostly fragmentary bird bone was found. Among are single bones identified as possibly coming from pigeon (*Hemiphaga novaeseelandiae*), kaka (*Nestor meridionalis*), duck (*Anas* sp.) and banded rail (*Rallus philippensis*).

Mammal bone was mostly dog (*Canis familiaris*) and was concentrated at the north-west corner of the excavated area. Here there were fragments of cranial bone, a left mandible, maxilla fragments and teeth, leg and foot bones, and rib fragments. Fragmentary bone was scattered widely throughout the square including more head and leg bones, also scapulae, pelvic bones, vertebrae and ankle bone (astragalus). The range of bone scattered throughout the midden deposit clearly show dog to have been an important part of the diet, at least in this phase of the occupation of Raupa and at this part of the site.

Other mammal bone included human, sea mammal, kiore (Polynesian rat; *Rattus exulans*) and possibly pig. Rat bone included mostly leg bones (three femurs, two tibias, and one humerus and fibula) a mandible and some teeth. The selective nature of the remains is an argument for the bones being discarded food waste and not the result of accidental death. Two pieces of sea mammal bone were the vertebra of a cetacean of dolphin size and some very fragmentary remains of rib bone from a large

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Fig. 10. Area I. Level II, 6 February 1987. View to west.

Fig. 11. Area I. Surface of Level III (Layer 5 midden), 28 January 1987. View to east.

or medium-sized whale. Pig may be represented by one vertebra. Human bone was not common. Positively identified was a patella (kneecap) and one tooth; there was also a rib fragment which may have been human. Except for the tooth, we must assume that these remains are evidence of use as food.

Level IV. The final phase of Maori occupation at Area I is represented by the surface of Layer 4. Layer 4 itself is probably the result of flooding which buried the midden layer beneath with as much as 300 mm of sandy material. At the top of this are some thin lenses of waterlaid charcoal (Fig. 4). Most of the Layer 4 surface was level but in the north-west quarter of the square it had been raised and broken up by the small tree which grew here. A single posthole was found in metre square D3.

Level IV represents a period after the main occupation of Raupa when this part of the settlement was no longer in use. It is possible the whole site was by now abandoned although the compact charcoal lenses suggest nearby fires and hence some occupation at this late stage. Above Level IV, at the surface of Layer 3, plough marks extended approximately east-west at the north-east corner and southern part of the square.

Adzes

One complete, one part adze and a blade fragment were found. The first two both came from metre square E2, the incomplete item from Layer 4 and the complete from Layer 3. There were no direct archaeological associations to indicate use or any particulars of the final deposition of any of the three items.

The incomplete item (Fig. 37) is the butt end of a rounded rectangular adze, one face (probably the front) slightly wider than the other. The fragment is 140 mm in length and 67 mm wide narrowing to a markedly round poll. The complete adze may have been *ca.* 200 mm long. Original surfaces are polished over extensive hammer-dressing. Considerable haft polish can be seen down the centre and at edges of the back to indicate much use of this adze. There is also a very little haft polish over the hammer-dressed butt. When the adze was broken there was an attempt made to fashion a new bevel by trimming back from the broken end; a few flakes were taken off before the adze was abandoned. The raw material is a medium to coarse-grained green Waiheke Group greywacke from the inner Hauraki Gulf islands or west side of the Firth of Thames (Schofield 1967).

The Layer 3 adze (Fig. 38) of rounded rectangular cross-section measures 130 x 58 mm and *ca.* 25 mm deep. Some hammer-dressing is visible beneath over-all polish. Grinding or polish scratches are visible front and back. Despite some use wear, the blade is still in excellent condition. The stone is good quality pale grey basalt probably from the Tahanga, Coromandel Peninsula, source (see Fig. 1).

From the surface of the midden layer in metre square A1 came a blade fragment of a well finished adze in green greywacke with small black inclusions. The piece measures 31 x 20 mm and *ca.* 7 mm deep, enough to identify the adze as being of rectangular cross-section. A broken angle has subsequently been smoothed off to indicate use of the fragment for a grinding or cutting purpose.

Worked bone

A fragment of worked bone, probably bird, was found in Layer 4, metre square D3 (Fig. 49). The piece measures only 26 x 13 mm. It has been cut or snapped on three sides and shows also some cut marks across the narrow end. It was probably a tattooing chisel, broken during manufacture or use.

From the midden layer, square A5, came a 36 mm long unfinished bone needle (Fig. 47). It is possible that it has been broken from a once larger needle but its similarity with a number of needles from Oruarangi (Fisher 1934: Figs 40-57) suggests this was very much the final shape but for the lack of a drilled eye. The bone is probably dog jaw (Fisher 1934: Figs 29-32).

Obsidian

From the various layers of Area I were recovered 216 pieces of obsidian weighing 771.3 g. The distribution of this material is outlined in Table 1. Fifty-seven per cent by weight came from Layer 3, 38% from Layer 4 and 5% from the Layer 5 midden.

Distribution was not spread evenly over the excavated area. In Layer 3 there was a concentration in metre squares D3 and E2-3 (43% of the Layer 3 total) and also in squares A1 (7%), and A3-4, B4 (28%). These seven squares alone accounted for almost 80% of the total. In Layer 4 only four metre squares (E1, E3, C4, E5) account for 70% of the total obsidian by weight. In Layers 3 and 4 there is little obsidian over the southern part of Area I. Not much, however, can be said concerning the distribution of so small a quantity of material over an area only 5 x 5 m; it is unrelated to any structural evidence and may be the result of one or two episodes such as the working of wood or fibre or the preparation of food.

The majority of obsidian flakes were small. Forty per cent of Layers 3 and 4 material were less than 1 g in weight with a like amount 1-5 g. Most of the remainder was 5-10 g. Only five pieces were more than 20 g, one of which, of 68.3 g, may have been used as a core. Only eight pieces showed any sign from the presence of edge damage of having been used as tools. Almost all the pieces are of green Mayor Island material, three pieces from square C4, Layer 4, being from the Waimata Stream, Waihi, source (Moore & Coster 1989). The 14.3 g weight of Waihi material is 1.9% of the total.

Chert

Thirty-four pieces of chert weighing a total of 232.6 g were recovered from Area I (Table 2). There was also a 17.6 piece of cream coloured chalcedonic material found among disturbed material of Layer 1. Twelve pieces came from Layer 3 (85.2 g), 16 from Layer 4 (103.7 g) and six from Layer 5 (43.7 g). Table 2 gives the distribution by layer and metre square.

There were no large pieces, the majority of items being less than 5 g in weight. The most common raw material is fine-grained and white, cream or yellow ochre in colour. Also present is cream, pink and yellow, brown-grey chalcedonic cherts, and coarser black, red and grey materials.

Table 1. Area I obsidian distribution, from 216 pieces of 771.3 grams.

Square	Layer 1		Layer 3		Layer 4		Layer 5	
	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).
A1	1	0.1	15	32.4	2	2.6		
B1			12	21.5	2	0.2		
C1			1	15.2			1	10.0
D1	1	0.2	1	2.8	2	3.9		
E1			7	12.9	2	106.2		
A2					1	19.1		
B2			3	2.1	1	5.7	1	12.1
C2			2	3.4	1	6.7	2	3.7
D2			1	1.0	3	7.0		
E2			14	61.5			1	1.5
A3			8	34.7			2	2.6
B3			3	10.1	10	21.6	3	1.7
C3			1	0.1	8	11.6	2	6.9
D3			33	69.2	2	1.7		
E3			9	56.6	5	40.4		
A4			12	63.9	1	0.5		
B4			12	25.4				
C4			5	7.3	7	33.0		
D4			3	3.0				
E4			2	2.6				
A5								
B5			4	0.9	1	6.9		
C5								
D5			2	8.8				
E5			3	0.5	1	29.5		
	2	0.3	153	435.9	49	296.6	12	38.5

Approximately ten items display edge damage, which is a comparatively large number out of the total of only 37 pieces. In Area III there was a similar number of utilised pieces out of 462 chert items. A fine-grained piece of chalcedonic quality (square B1, Layer 3) was edge damaged and smudged with red ochre. A piece of the common off-white variety of chert (E1, Layer 4) displays edge damage in addition to possibly having been used as a drill-point. A second possible drill-point which also displays considerable edge damage was found in square E4 Layer 5. This item was of comparatively coarse-grained brown chert with black and opaque white chalcedonic inclusions, identical to the raw material of a 17.5 g core fragment from the same square (but assigned during excavation to Layer 3) which shows systematic reduction of the sides from two opposite platforms *ca.* 25 mm apart.

Table 2. Area I chert distribution, from 36 pieces of 238.5 grams.

Square	Layer 3		Layer 4		Layer 5	
	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).
A1						
B1	2	26.2				
C1						
D1			8	27.9		
E1	2	23.4	2	13.1		
A2	1	6.6	1	21.7		
B2	1	1.2				
C2	2	4.4			2	19.6
D2			1	11.2		
E2	1	3.9				
A3					1	4.0
B3						
C3						
D3						
E3			1	6.8		
A4						
B4						
C4	1	0.9				
D4						
E4	1	17.5			1	4.3
A5			2	14.3		
B5						
C5						
D5	1	1.1				
E5			1	8.7	2	15.8
	12	85.2	16	103.7	6	43.7

Kokowai

Kokowai or red ochre paint was present in Areas I-IV in the form of innumerable tiny pieces throughout the Maori occupation levels. In many areas within the excavations every scrape of the trowel revealed another piece or pieces. Kokowai was especially abundant in Areas III and IV, but in Areas I and II also it was very common.

The ochre was almost all in very small pieces, only rarely was a piece found greater than 10 mm in its greatest dimension. The pieces were of a fine soft consistency which probably had been processed, by burning and grinding if haematite was used as a raw material, then mixing with shark oil (see Te Rangi Hiroa 1966:319; E. Best 1924 II:543-545). Haematite rock is available in the nearby Coromandel Ranges. Alternatively ochre may have been obtained from streams or swamps where particles

coloured red by iron oxides were collected on bunched fern fronds placed in the water. Raupa kokowai was of two colours: most was a dark wine red or magenta colour, 10% or less was orange ('brick') red.

Kokowai was the most widely used of a limited range of Maori 'paints'; other colours were blue, black, white and possibly yellow (E. Best 1924 II:543-545). It was painted on the body, on cloaks or other clothing, on canoes, and on buildings or other structures. The flecks of kokowai throughout much of the Raupa site are indicative of widespread use and heavy application of this important decorative material.

There are two items from Area I which relate to the manufacture of kokowai. A small, 3.7 g weight, piece of soft haematite (or cinnabar?) of wine red colour is probably raw material. A 130 x 85 x 60 mm water-rolled stone of volcanic origin, possibly andesite, has been used in the preparation of kokowai. Large pieces have been broken off the stone which now weighs 850 g; water-rolled and broken surfaces alike have thick patches of kokowai adhering to them.

Pumice

Among ten pumice fragments from Area I is an angular piece, 70 x 47 x 33 mm, extensively used to polish (wooden?) shafts and, by way of sharp edges, inside narrow grooves. It came from metre square E3, Layer 5B. Another unusually large piece of water-rolled pumice, *ca.* 90 x 70 x 50 mm looks eminently suited to polishing or burnishing but has not been used. Other pieces are mostly only 20-30 mm in maximum dimension and are almost certainly naturally deposited.

Other stone

The most abundant stone by far in Area I were oven stones, mostly very fragmentary but some intact or missing only a few heat fractured spalls. Some oven stones can be seen piled up outside the excavation area in Figs 5 and 9.

In addition to material already discussed some quartz, petrified wood, andesite and greywacke fragments were recovered. Two pieces of very crumbly quartz crystal aggregate were recovered from Layer 3, square B4, and Layer 5, A3. They may be waste from chert or other imported stone material or were perhaps brought to the Raupa site for crushing and use as a highly abrasive grinding agent in the manufacture of stone tools. Two small pieces of petrified wood weigh only 2.8 g (C4, Layer 4) and 3.1 g (D2, Layer 5) respectively. Petrified wood was used in the manufacture of fishing lure shanks but these pieces are rubbish, being much too small for any use. Two fragments of grey and green greywacke belong to the important Waiheke Group raw material, again they are waste only.

Kauri gum

Several fragments of highly degraded kauri gum were found in the midden layer, square E1. This may have been an entirely natural occurrence but it was worth remembering that one method of preparing tattoo pigment was from soot obtained by burning kauri gum (Te Rangi Hiroa 1966:296).

Seeds

Charcoal hinau (*Elaeocarpus dentatus*) seeds were recovered from the midden layer, mostly from the eastern and southern margins of the excavated area. Approximately twelve half (split) seeds are represented as well as fragments.

Material of European origin

From Area I came more items of European origin than any other part of the Raupa site. Eight fragments of a pale green high kick-up wine bottle of typical nineteenth century shape (see Prickett 1981:397,399) totalled 52 g. They were scattered through Layer 3, the surface of which showed some plough marks but the base lying on the Level IV occupation surface. The bottle glass fragments probably relate to farming activity of the late nineteenth century prior to the mining up-river which buried the area in silt and rock flour.

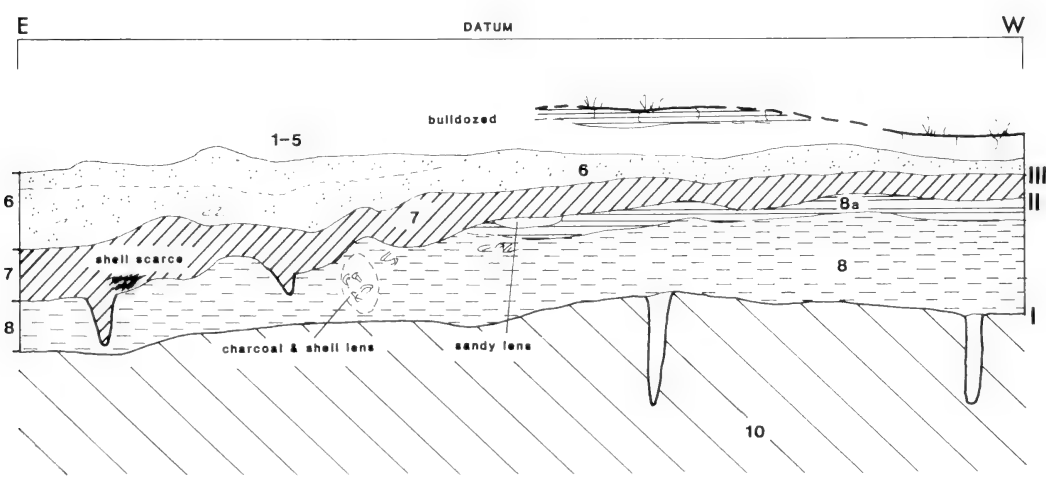
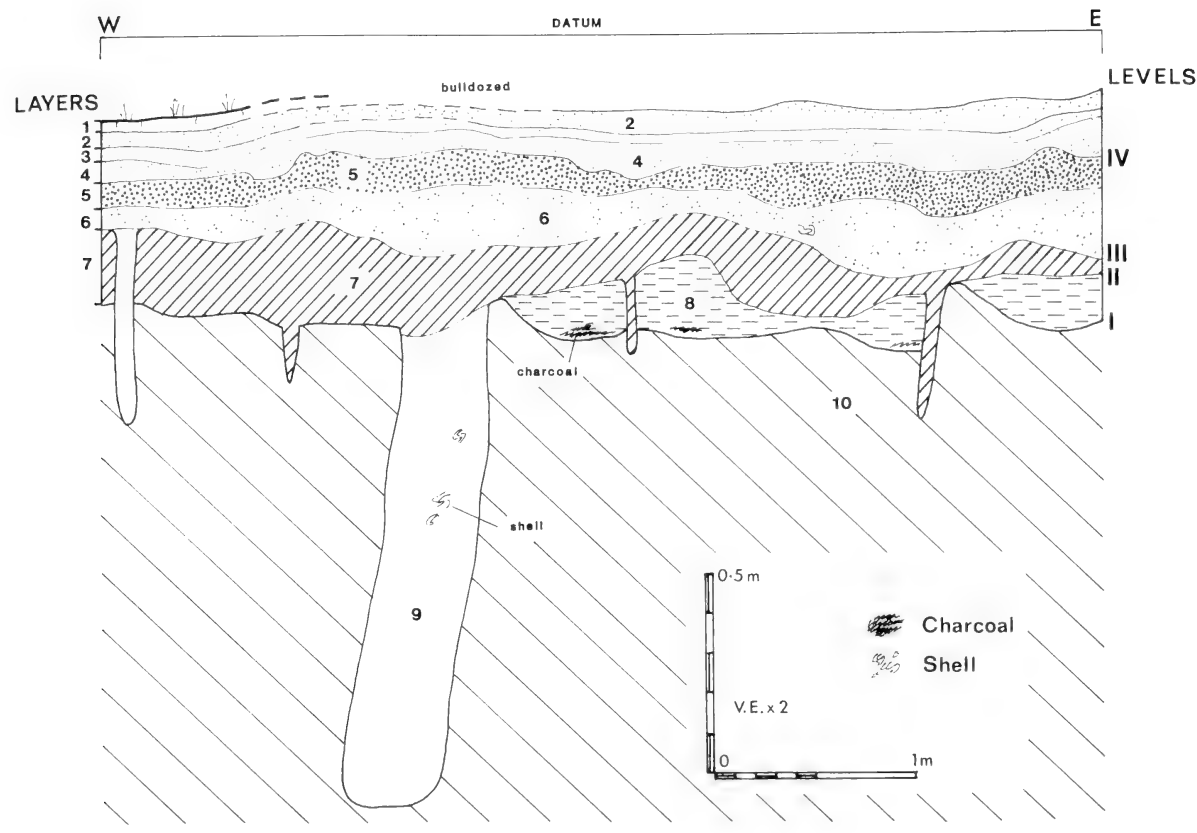
Other European material to come from Area I included a 1 g fragment of a brown glazed jar similar to ink bottles of the mid or late nineteenth century (cf. Prickett 1981:419). Like the bottle glass pieces it was recovered from Layer 3. Also from Layer 3 were four completely rusted iron fragments — three of thin sheet or strap iron and one probably of a nail or piece of wire.

AREA II (Figs. 2,12-22)

In her 1984 excavation Phillips concentrated area excavation along the sides of the major, north-south, Trench E (Fig. 2; and see Phillips 1986:101). Most work went into Areas '1' and '2' where an overlying compacted clay road, dating from the Catchment Board work of a few years before, slowed work and prevented full excavation of the cultural deposits beneath. In 1987 Area II was laid out a few metres east of the 1984 work to further look at this part of the site. The initial 5 x 5 m square was later extended to 30.75 m² to fully investigate a rectangular food storage pit which was revealed at the west side of the excavated area.

Stratigraphy

There are strong similarities in the basic stratigraphy of Areas I and II. In both areas cultural deposits were buried beneath silt and rock flour. The earliest occupation surfaces in both areas showed the remains of wooden structures, and were in each case overlain by black soil containing shell and other midden. Representative north and south sections of Area II are given in Figs. 12 and 13. At the south side of the square cultural deposits are 450-500 mm deep with almost all the overlying rock flour, silt and redeposited soil (Layers 1-5) removed. At the north baulk, however, several of these post-occupation layers remain to give a total depth of 500-600 mm. Also at this baulk is a 1.2 m deep post hole with the remains of a massive post still *in situ* at the bottom. Stratigraphic layers illustrated in Figs. 12, 13 are as follows.



Figs. 12,13. Area II stratigraphic sections. 12. North section (above). 13. South section (below). Layer descriptions in text.

- Layer 1. Loose yellow-brown silt and re-deposited soil.
- Layer 2. A very distinctive 50-100 mm band of compacted yellow rock flour.
- Layer 3. Band of pink compacted rock flour, *ca.* 50 mm, with 10-20 mm band of black silt loam above and below.
- Layer 4. Zone of mixed silts and black silt loam, 50-100 mm.
- Layer 5. Deep chocolate brown silty clay, 50-100 mm.
- Layer 6. Black silty clay 50-200 mm deep, with plentiful charcoal and rare shell. At the south side of the square (Fig. 13) Layer 6 comprises a black sandy loam, again with abundant charcoal, and the upper part of the east end tending to brown.
- Layer 7. Shell midden in black or brown silt loam; abundant charcoal.
- Layer 8. Grey and brown sandy loam with scattered lumps of charcoal and rare shell especially at the south side of the square (Fig. 13); 50-250 mm deep, tending deeper to the south.
- Layer 8A. Black sandy loam, stratigraphically part of Layer 8.
- Layer 9. Posthole fill at north baulk.
- Layer 10. Yellow clay natural.

The occupation sequence

In Area II are three basic occupation levels relating to the Raupa settlement. Evidence of subsequent use of the site makes up a fourth occupation period. Occupation levels may be briefly listed as follows:

- Level I. Scatter of post and stake holes and storage pit — at base of site.
- Level II. Hangi pits and post holes represent cooking activities.
- Level III. Area covered in shell and other midden.
- Level IV. Evidence of ploughing.

Level I. As in Area I the first use of this part of the site saw a number of wooden structures built over the 25 m² which was initially investigated (Figs 14,15). Unlike Area I, however, there is little sense to be made of the scatter of post and stake holes revealed except for two lines of large postholes which extend roughly parallel north-south across the centre and west side of the square. These postholes are 150-530 mm in depth, tending to the greater depth at the north end of the exposed lines. It is doubtful if the two lines are part of a roofed structure and there was no other evidence for this. More likely they signal the remains of a double line of stockade or fence posts, probably for an internal division within the larger fortified settlement.

At the north baulk between the two post lines was a single massive post ('A' in Fig. 14). This first became apparent in the (hangi) layer above but clearly belongs with Level I. The hole was 1200 mm deep and angled down to the west. Within the hole was a distinctive post mould at the bottom of which was the surviving base of the post, identified as kahikatea (*Podocarpus dacrydioides*), the big timber tree of the plains and available in abundance near Raupa. At the south-west side of the posthole was a small 'step', dug probably to ease the raising into place of such a large post. It is possible that a single post such as this supported a storage platform or pataka. More likely it relates to the lines of posts extending to either side of it, and if these do mark an internal division of the pa then such a very large post may be part of a strongpoint or gateway.

There are two other wood identifications from Level I postholes. From posthole 'B' (see Fig. 14) came tawa (*Beilschmiedia tawa*) charcoal fragments, part of the fill and not necessarily indicating the original post timber. In posthole 'C' (Fig. 14) decayed fragments of kauri were found upright in the hole showing that this was timber from the post which stood here. The post is one of a line which it has been suggested may represent an internal stockade.

At the west side of Area II we were fortunate to strike the end of a rectangular food storage pit. The excavation was then enlarged to take in the whole of this new find (Figs. 14,15). The pit was 3.1-3.15 m long and 1.6-1.8 m across, narrowing to floor dimensions of 2.95-3.05 m length and 1.2-1.35 m width. The depth was approximately 800 mm.

Figs 16 and 17 illustrate the west end of the pit. Clearly visible in the photograph are the clay road, banded layers of flood deposited silt and rock flour, crushed shell midden (Level III) and the end wall of the pit. There were no drains on the pit floor. The few shallow stake holes (shown in Fig. 14) belong to Level II structures having been driven through the soft fill and into the floor of the pit beneath.

More information came from the pit contents. This included a large quantity of wood charcoal concentrated on the floor where it made up a compact mass 50-100 mm in depth. Identifications are listed in Table 3. The mass of charcoal almost certainly relates to a single episode of burning and probably includes the remains of the pit roof as the charcoal lay on the floor with no evidence of a period of disuse prior to the conflagration. The predominance of tawa is thus interesting and may denote structural or cladding timber. The variety of small tree and shrub species at the west end of the pit suggests wood deliberately brought together for a fire.

Of interest is the narrow margin for a dry storage pit in a low lying area such as the Hauraki Plains. Only 2 m from the pit is the massive north baulk posthole dug 1 m deeper than the pit floor. The fact that 700-800 mm of the post itself was preserved in the watertable shows just how close was the margin for error.

Level II. Level I occupation of Area II ended when a mixed sandy clay loam with rare shell and charcoal was brought in and spread over the former occupation surface. Numerous shallow hangi scoops show that the area was now used for cooking (Figs. 18-20).

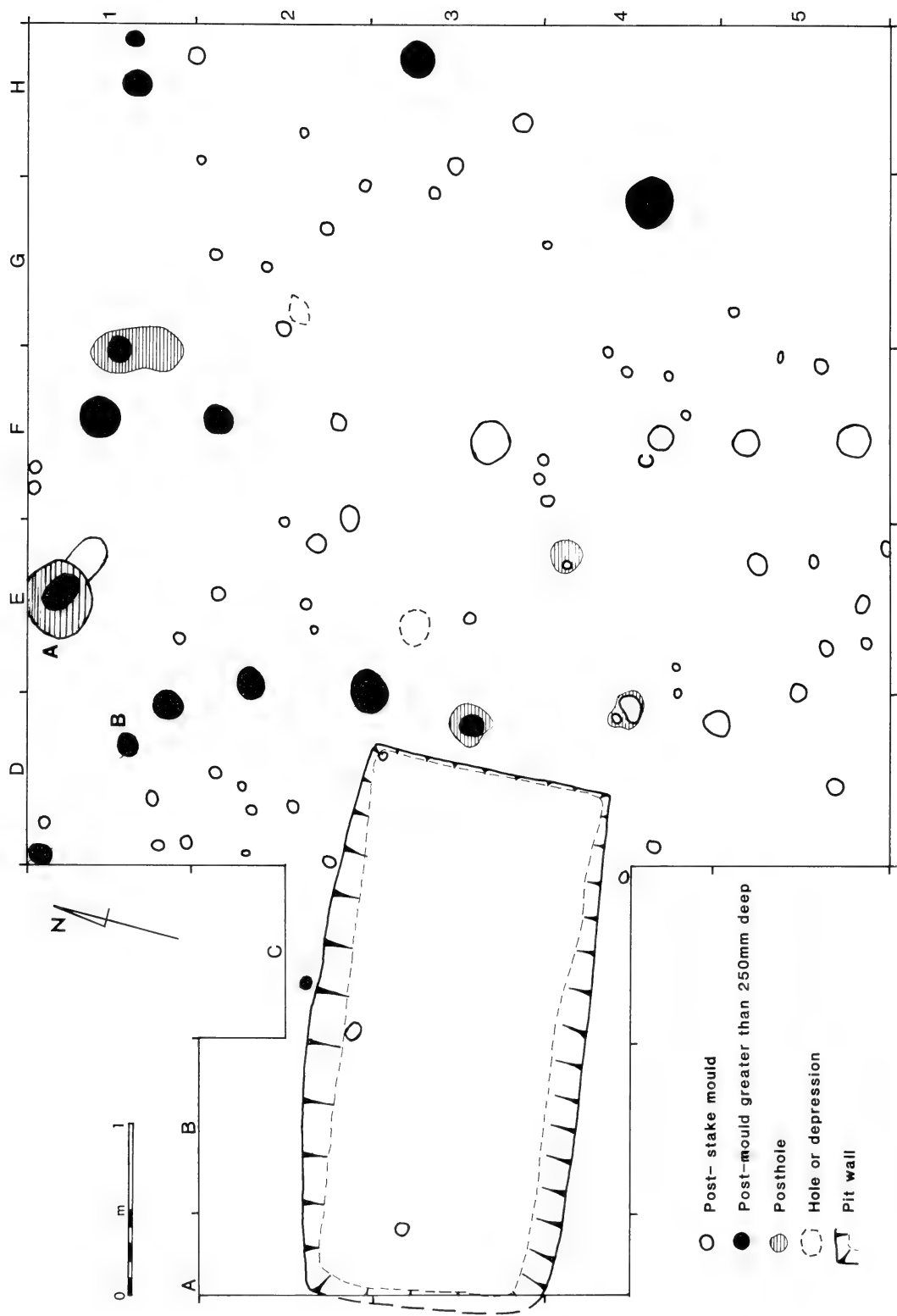


Fig. 14. Area II. Level I plan.

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Fig. 15. Area II. Level I, 11 February 1987. View to west.

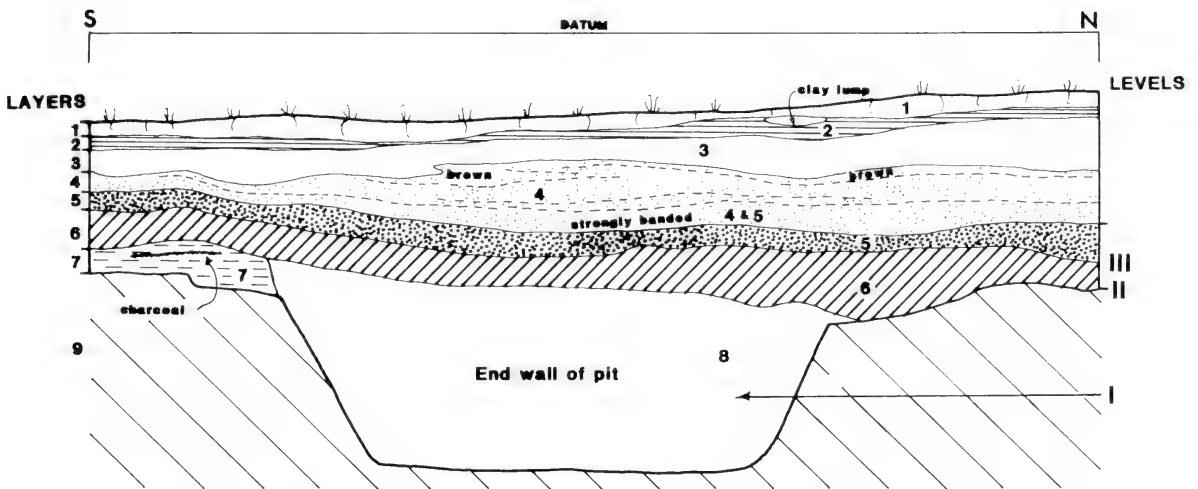


Fig. 16. Area II. West end of excavated pit. Layers. 1. Turf. 2. Compact pale brown sandy clay on surface of clay road. 3. Hauraki Catchment Board (*ca.* 1980) clay road. 4. Thin lenses of highly compacted yellow, pink and pale brown silt. The lower part of Layer 4 includes some strong black bands similar to underlying Layer 5. 5. Black silty clay with plentiful charcoal. (Layer 6 in Figs. 12 and 13). 6. Shell midden in black soil. (Layer 7 in Figs. 12,13). 7. Yellow-brown sandy loam with charcoal. 8. Removed from pit was deep soft silt loam, abundant charcoal especially near pit floor. 9. Unexcavated yellow clay material.

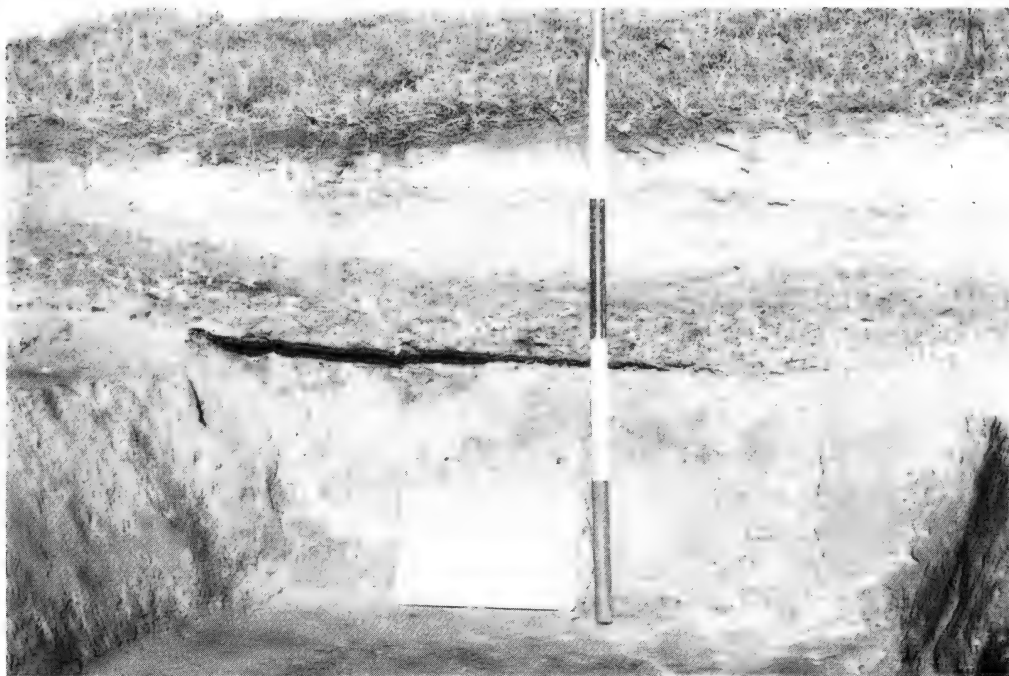


Fig. 17. Area II. West end pit section, 19 February 1987.

Table 3. Area II, pit charcoal identifications.

1.	Pit floor west end.	
	<i>Beilschmeidia tawa</i> — tawa	2
	<i>B. tarairi</i> — taraire	1
	<i>Hebe</i> sp.	3
	<i>Kunzia ericoides</i> — kanuka	2
	<i>Leptospermum scoparium</i> — manuka	6
	A vine species — not <i>Metrosideros</i>	1
	<i>Myrtus bullata</i> — ramarama	4
	<i>Hoheria</i> — ribbonwood, lacebark } <i>Plagianthus</i>	1
	<i>Coprosma</i> sp.	2
	<i>Myrsine salicina</i> — toro	2
	Total identifications	24
2.	Pit floor east end (north). Large sample all tawa.	
3.	Pit floor east end (south). Large sample all tawa.	

Approximately twenty hangi scoops, some dug into earlier ones, were 100-250 mm deep and typically 800-1200 mm in diameter. Hangi stones were plentiful throughout and grouped in places where they were abandoned at the end of this phase of activity.

Level II charcoal samples are listed in Table 4. Sample locations are shown in Figure 18 (A-D). At least 13 species were identified among which the shrub ramarama (*Myrtus bullata*), *Coprosma* species and tawa were abundantly represented. Other shrubs and small trees are also listed. The sole large timber tree identified is matai which is represented by twig wood only. The variety of wood and the occurrence of twig and branchwood reflects the choice of firewood for cooking. This may have been collected from local forest and shrubland or as driftwood from the river bank at the settlement site. Approximately 15 mostly fragmentary hinau seeds were found throughout Layer 7.

Scattered over the 25 m² area are a number of postholes of which little can be said except that those within hangi scoops must post-date the cooking activities. At the west side of the square is a hangi dug partly into the soft fill of the Level I pit. Driven

Table 4. Area II Level II charcoal identifications (located on Fig. 18, Samples A-D).

1.	Hangi scoop contents. Sample A.	
	<i>Myrtus bullata</i> — ramarama	95%
	<i>Prumnopitys taxifolia</i> — matai	twig wood
	<i>Coprosma</i> sp.	twig wood
2.	Sample B.	
	<i>Weinmannia silvicola</i> — towai	1
	<i>Myrsine australis</i> — mapou	2
	<i>Beilschmiedia tawa</i> — tawa	2
	<i>Melicytus ramiflorus</i> — mahoe	3
	<i>Lagorostrobis colensoi</i> — pink pine	1
	<i>Myrtus bullata</i> — ramarama	4
	<i>Brachyglottis repanda</i> — rangiora	1
	<i>Coprosma</i> sp.	1
	<i>Kunzia ericoides</i> — kanuka	1
	Total identifications	16
3.	Sample C.	
	All tawa branchwood 20-25 mm in diameter.	
4.	Sample D.	
	Fern stem (bracken?)	1
	<i>Myrtus bullata</i> — ramarama	1
	<i>Beilschmiedia tawa</i> — tawa	7
	<i>B. tarairi</i> — taraire	1
	<i>Leptospermum scoparium</i> — manuka	3
	Total identifications	13

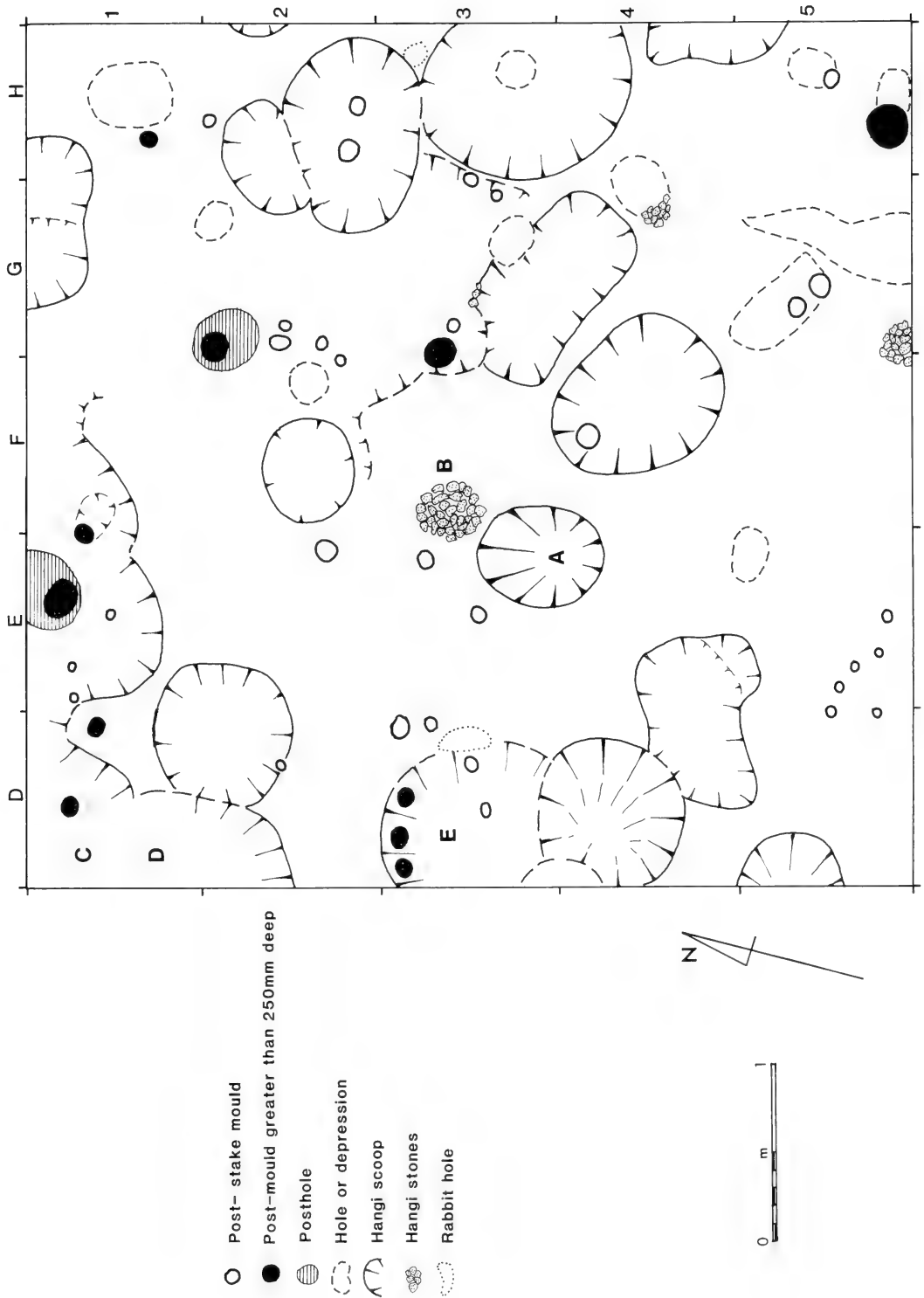


Fig. 18. Area II. Level II plan.

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Fig. 19. Area II. Level II, 2 February 1987. View to west.

Fig. 20. Area II. West section detail showing Level II oven scoop beneath shell midden,
6 February 1987. Pit excavation at right.

500-600 mm into the fill (and pit floor) at the north side of the scoop (marked 'E' in Fig. 18) are three stakes which provide a strong structural support in this part of the cooking area.

Level III. After being used for cooking Area II was covered to a depth of 50-250 mm by a layer of shell midden and black soil (Fig. 21). Much of the shell was crushed indicating it had been moved about more than once after being discarded as food refuse.

Such a spread of waste material suggests that cooking activities were now being carried out nearby and/or that this part of the Raupa settlement was now deliberately levelled up to provide a surface suited to human traffic and activities. There were, however, no postholes or any other indication of what use might have been made of the area. It is possible that the lack of activity or use apparent at Level III suggests a contraction of Raupa so that Area II is now at the edge of the settlement rather than near the centre as formerly. Perhaps this relates to the period after the Nga Puhi attack when a reduced number of people may have stayed on at the pa.

During the excavation shell midden was collected both as bulk samples and particular items of interest. Identifications from one bulk sample are given in Table 5. The table confirms the impression that throughout the excavated area Layer 7 shell midden was made up of approximately 85% pipi, 10% cockle and 5% other species. In the sample there may be more cockle and there is certainly more *Mactra* than was usual throughout the site. Table 6 lists 19 shell species identified from among the crushed and scattered remains in Layer 7 (Level III).

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Fig. 21. Area II. Levels II and III, 28 January 1987. View to north-west.

Table 5. Area II Layer 7 bulk midden sample (taken from 'E' Fig. 18).

	Number	Percent
<i>Paphies australis</i>	622	76.5
<i>Chione stutchburyi</i>	121	14.9
<i>Mactra discors</i>	52	6.4
<i>Perna canaliculus</i>	5	0.6
<i>Cominella glandiformis</i>	5	0.6
<i>Xymene ambiguus</i>	2	0.2
Unidentified gastropod fragments	2	0.2
<i>Cominella adspersa</i>	1	0.1
<i>Pecten novaezelandiae</i>	1	0.1
<i>Taron</i> sp.	1	0.1
<i>Dosinia anus</i>	1	0.1
	813	99.8
<i>Chrysophrys auratus</i> — snapper	teeth	

Table 6. Area II Layer 7 shells present.

<i>Pecten novaezelandiae</i> — scallop
<i>Perna canaliculus</i> — green mussel
<i>Hyridella menziesi</i> — freshwater mussel
<i>Chione stutchburyi</i> — cockle
<i>Cominella adspersa</i> — speckled whelk
<i>Sigapatella novaezelandiae</i> — circular slipper shell
<i>Buccinulum vitatum</i> — lined whelk
<i>Cominella glandiformis</i> — mud whelk
<i>Amphibola crenata</i> — mud snail
<i>Paphies australis</i> — pipi
<i>Maoricrypta monoxyla</i> — white slipper shell
<i>Maoricrypta costata</i> — ribbed slipper shell
<i>Turbo smaragda</i> — catseye
<i>Maoricolpus roseus</i> — turret shell
<i>Xymene plebeius</i> — small rock trophon
<i>Mactra discors</i> — large trough shell
<i>Xymene ambiguus</i>
<i>Taron</i> sp.
<i>Dosinia anus</i> — coarse dosinia

Four fish species were identified from the scattered and fragmentary bone of the midden layer. Much the most abundant was snapper. Eagle ray was represented by four tooth plates and 51 vertebrae scattered throughout the square. Kahawai and gurnard were represented by a single vertebra and operculum respectively. Two tiny vertebrae were provisionally identified as yellow-eyed mullet (*Aldrichetta forsteri*). Some fishbone had been chewed by dogs.

Very fragmentary mammal bone also was scattered throughout Area II midden level. Dog bone includes mandible, maxilla and cranial pieces, two cervical vertebrae and two metacarpals. These probably indicate the butchering of dogs for consumption. Kiore was represented by a femur and tibia. A fragment of whale (cranial?) bone was extensively chewed by dogs. Two pieces of pig bone were found together at the east side of the square. A cervical vertebra has been chopped down two sides, presumably during butchering. A fragment of the distal end of a left humerus is close to the size of a six-month old animal. Nearby was a single tooth, possibly human.

Level IV. Leaving aside the remains of the clay road above the west end of the pit and the rock flour from the up-river mining operations which covers the whole site, the last human activity to have left archaeological evidence in Area II is shown in Fig. 22. On the surface of Layer 5 a series of shallow ditches are scored east-west across the square approximately 750 mm apart. Associated are numerous more or less defined holes approximately 150 mm in diameter and never more than 120 mm deep.

The shallow ditches were quickly identified as plough lines. More speculative is the suggestion that the associated holes are the footprints of a draught animal which pulled the plough. Judging from the size and depth of these holes it is suggested further that bullocks not horses were the animals used. This ploughing of the Raupa site must date from the late 19th century before the Karangahake Gorge mines filled the river and covered the nearby plain in rock flour waste from quartz crushers.

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Fig. 22. Area II. Level IV ploughlines, 17 January 1987. View to west.

Stone material

Area II was notable for the lack of waste stone material. Nor were any fashioned artefacts found. Seven tiny pieces of green, probably Mayor Island, obsidian totalled only 2.7 g. All came from the midden deposit (Layer 7) and with the exception of one piece of waste all are from the northern edge of the square.

Only four pieces of creamy-white and grey chert were recovered totalling 18.7 g. A 1.2 g fragment of quartz and a small piece of petrified wood the same weight complete the stone material. With the exception of the petrified wood this material all came from the south-west corner of the square. Thus the chert, like the obsidian, might be accounted for by a single event. Except for the large quantity of oven stones throughout the site, associated notably with the Level II occupation, there was no other stone material of cultural origin.

Small (less than 15 mm maximum dimension) fragments of water-rolled pumice were found mostly in Layer 8. These clearly relate to episodic flooding at the Raupa site.

Worked bone

A flat fragment of bone 25 x 11 mm and 4 mm deep has been sawn and snapped along one margin. The other edges are roughly broken. This item was found in metre square H3, Layer 6.

Material of European origin

The only item of European origin from Area II was a broken fragment of thin flat aqua glass, possibly from a window. It was found on the surface of the midden layer in square F5 and may therefore relate to the Maori occupation of the Raupa settlement, but more likely dates from the episode of ploughing represented by Level IV.

AREA III (Figs. 2,23-30)

Areas III and IV were opened up on a part of the Raupa site just north of the 1983 'Trench A' and approximately 100 m south of the innermost of the three defensive ditches which cut the narrow neck of the old river bend (Fig. 2). A wide area was prepared here by grader so that the two initial 5 x 5 m squares could be extended as seemed profitable. As it turned out Area III was eventually expanded to 107.6 m² and here was focussed the major effort of the latter part of the six week excavation season.

Stratigraphy

Over most of Area III the natural base of the site was not reached for the reason that it was decided to concentrate on exposing as much as possible of an upper occupation level. Hence we do not have a full occupation sequence of this part of the Raupa site. Excavated depth varied from 220 mm in the south-east corner of Area III, to 350 mm at the north-east corner and 450-500 mm on the west side and north-west corner. The stratigraphic sequence is as follows.

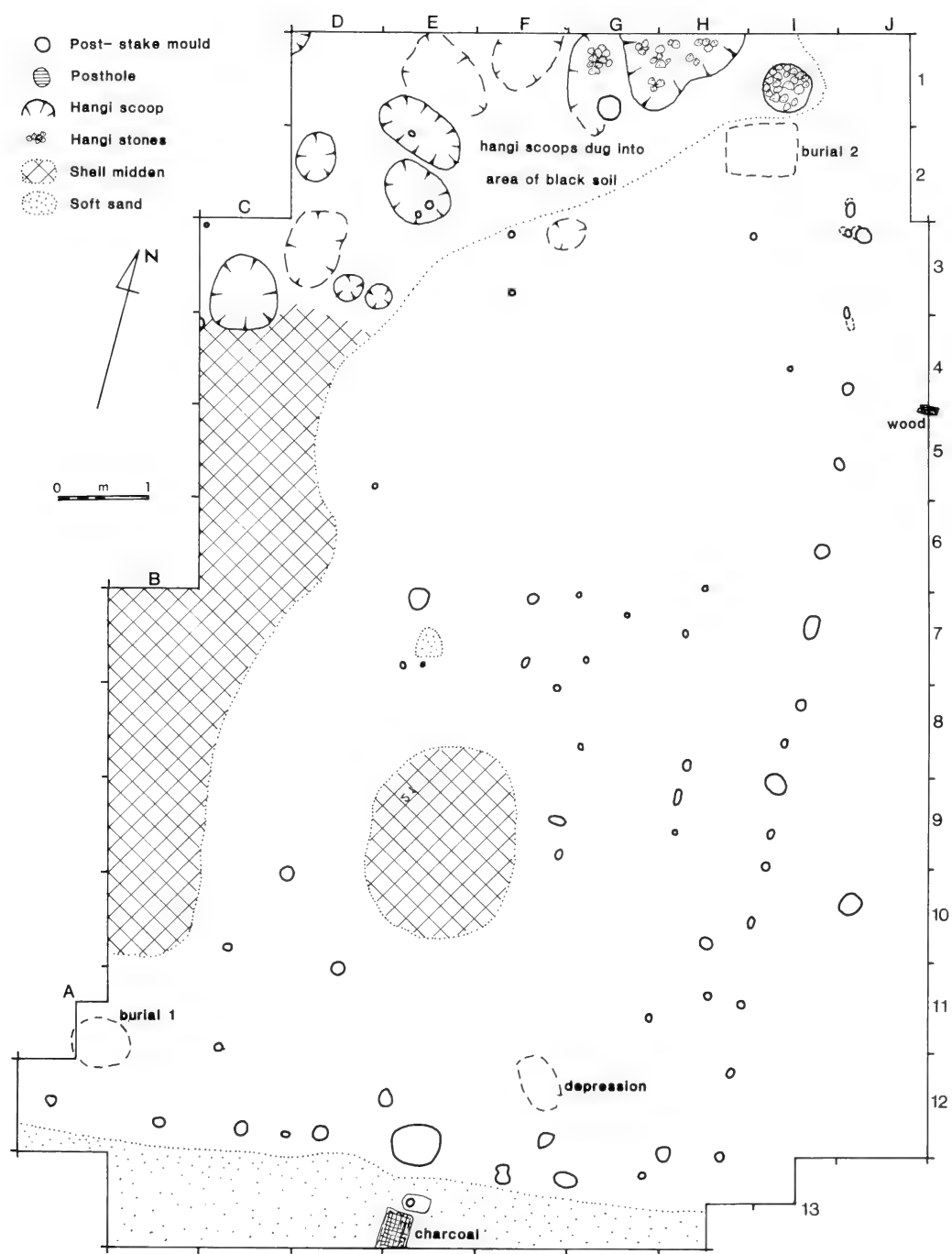


Fig. 23. Area III. Plan.

- Layer 1. Up to 60 mm of silt and rock flour overlay parts of the excavated area having been left by the grader which successfully removed most of this material. Over some of Area III excavation began with Layer 2.
- Layer 2. Beneath the recent flood deposits was a compact hard grey silt loam, 50-120 mm deep, with pale grey clay inclusions.
- Layer 3. A comparatively soft brown clay loam 100-200 mm in depth incorporated fine charcoal and ochre fragments, also numerous pieces of obsidian and chert. Within this layer were lenses of soft crumbly chocolate brown loam with comparatively little artefactual material.
- Layer 4. Layer 4 was signalled over most of Area III by a hard black and grey surface of sandy clay loam. This was the only excavated occupational level of Area III. Over much of the north and west part of the excavated area the distinctive compact occupation surface was replaced by hangi scoops and shell dumps (Fig. 23). The former were dug into black sandy silt loam at the north end of the excavated area, while the loose shell midden was mostly contained in a pale sandy soil including some lenses of almost pure sand.

Layer 4 occupation surface

The important find of Area III, and indeed the most interesting discovery of the 1987 excavation season at Raupa, was the remains of a large rectangular house. This measured *ca.* 10.5 x 6.25 m, and occupied *ca.* 65.6 m², thus taking up a large part of the excavated area in this part of the site (Figs. 23,24). It was to fully reveal and explore this building and its immediate environs that Area III was expanded to a total of 107.6 m² (see Figs. 23-25).

A hard trodden surface marked the floor of the house. This was variable in colour, mostly grey but tending to black in places. The material was a gritty, sandy clay loam. The compacted depth of the occupation surface was up to *ca.* 100-120 mm. Although the underlying layers (and occupation levels) were not excavated the Layer 4 occupation surface was trowelled down 20-100 mm in places during the search for structural features related to the house. Many postholes were not apparent at the floor level but needed repeated stripping of 10-20 mm thicknesses of Layer 4 before they were found (see Fig. 25).

By good fortune the most distinguishable part of the house plan was contained within the initial 5 x 5 m excavation square. Here was the south-east corner of the building which enabled us to predict exactly the direction of the south and east walls (Fig. 24). Table 7 lists posthole data for all of Area III including the large house.

The size of the house is indicated by the east and rear walls. From the corner post (49 — see Fig. 24) to the group of three close-set posts at the north end of the wall is *ca.* 10.5 m. The corner post itself proved smaller than most side wall posts. The group of three posts which mark the north end of the wall are all angled into the ground presumably to increase their combined strength.

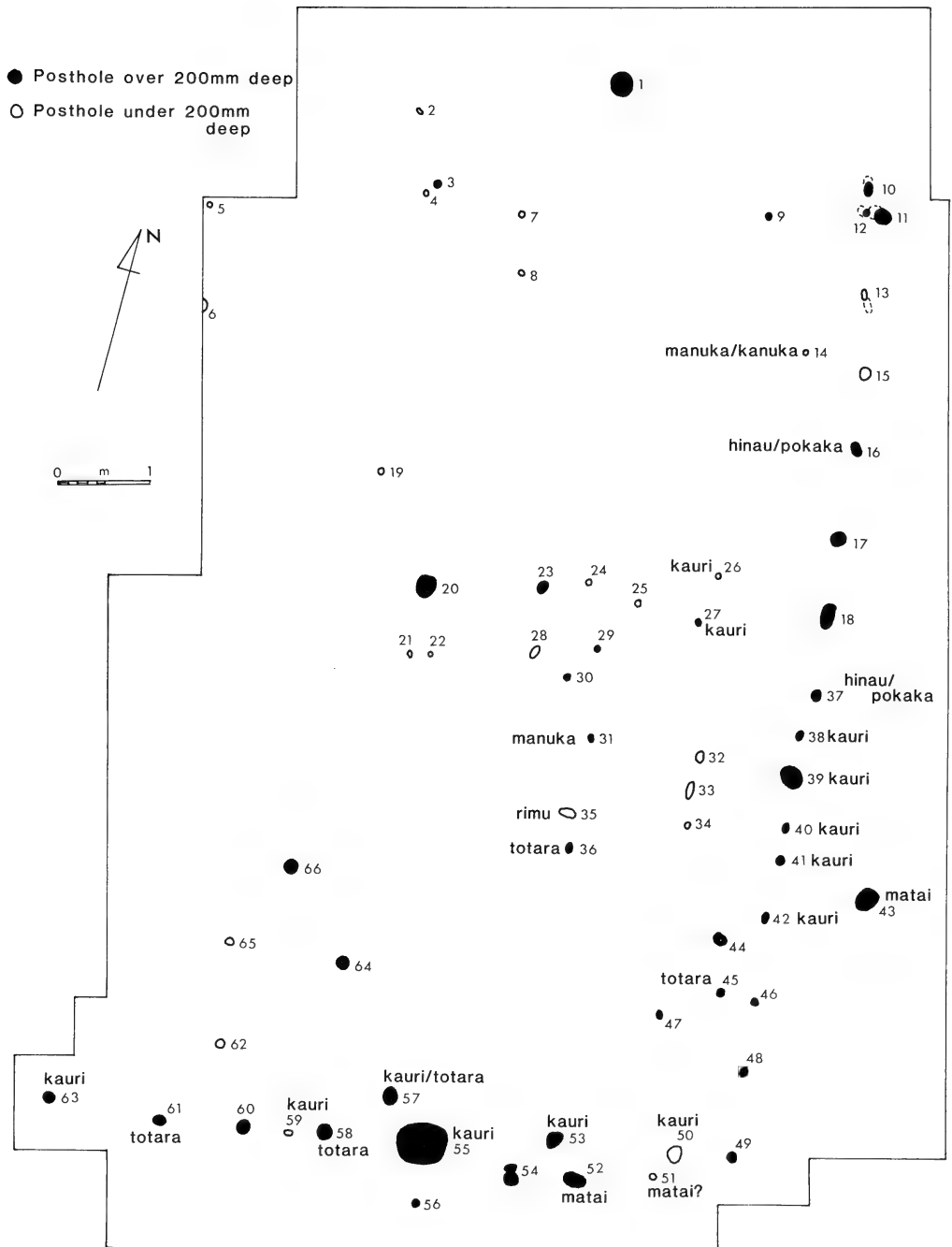


Fig. 24. Area III. Posthole information. Numbers refer to Table 7.

Table 7. Area III posthole data (refer to plan, Fig. 24).

Posthole number	Plan measurements (mm)	Depth (mm)	Notes including timber identification if available
1	190-180	34	
2	70-50	90	
3	80-80	230	
4	50-50	50	
5	70-60	110	
6	140-140	180	
7	50-50	70	
8	60-60	170	
9	70-70	200	
10	190-160	270	Angled down to north
11	190-160	490	Angled down to west
12	100-80	250	Angled down to west
13	110-60	190	Angled down to south
14	60-60	120	manuka/kanuka — charred wood
15	130-120	90	
16	170-130	370	hinau/pokaka (<i>Elaeocarpus</i> sp.) — charcoal
17	150-150	210	
18	250-200	330	
19	60-60	80	
20	230-200	370	
21	80-60	120	
22	70-70	70	
23	100-90	240	
24	80-60	110	
25	50-50	160	
26	70-70	110	kauri — chunks of unburnt wood
27	90-60	260	kauri — upright slivers of unburnt wood
28	130-80	180	
29	90-80	450	
30	70-70	200	
31	60-40	200	manuka — charcoal fragments from stake hole
32	100-90	150	
33	160-70	160	
34	60-50	110	
35	180-90	160	rimu — upright slivers charred at top
36	140-80	380	totara — chunks of charred wood and charcoal
37	110-110	300	hinau/pokaka — charcoal
38	100-90	450	kauri — wood charred at end
39	250-250	380	kauri — charred wood and charcoal including resinous knot wood
40	100-80	230	kauri — slivers some charring at top
41	100-100	440	kauri — wood slivers
42	110-60	290	kauri — wood slivers
43	270-230	630	matai — massive piece of straight-grained timber. Also slivers, some burned at top rimu/totara/kahikatea/miro — too decayed to distinguish. 130 mm long 60-70 mm round cross-section

Posthole number	Plan measurements (mm)	Depth (mm)	Notes including timber identification if available
44	120-120	600	
45	90-80	300	totara — charcoal and charred wood
46	70-70	260	
47	100-90	450	
48	110-90	360	
49	100-90	350	
50	170-170	190	kauri — unburnt slivers
51	80-80	80	matai? — unburnt slivers
52	200-170	350	matai — unburnt slivers
53	170-120	230	kauri — slivers charred at top
54	200-150	200	rimu/totara/kahikatea or miro — highly degraded unburnt slivers not identifiable as to species
55	530-460	420	kauri — massive piece of timber charred at top and including resinous knot wood Also in posthole kauri/rimu and mapou charcoal
56	80-60	200	
57	180-120	310	kauri — slivers and resinous wood
58	170-170	310	totara — fragmentary slivers from base of hole
59	70-70	70	totara — charred wood fragments
60	180-160	200	kauri — unburnt wood
61	130-90	280	totara — charred wood rimu — charcoal line adjacent to post
62	80-60	110	
63	170-170	270	kauri — slivers and pieces, no burning
64	150-150	550	
65	100-90	90	
66	180-160	570	

The house rear wall is centred on a very large ridge post the mid-point of which is *ca.* 3.35 m from the south-east corner post (see Fig. 26). However, despite much searching we were unable unequivocally to define the south-west corner post or to find any of the west side of the house. The reason for this was either that we did not search a wide enough area or, more likely, that this part of the house, which was dug over later for cooking ovens and subject to the dumping of midden, has been destroyed. The midden was removed and hangi scoops cleared out by excavation but still there was no sign of a line of posts comparable to the east side of the house. It is possible the house was markedly asymmetrical and that we did not take in a wide enough area to find the west side. Posthole 63 (see Fig. 24) 4.05 m from the ridge post is on line to have been a corner post and if it was may have put the west wall outside the excavated area. But this would have meant three posts on one side of the rear centre and four on the other. More likely the corner post is that marked '61' in Fig. 24. This would retain the balance of three posts on either side despite the different dimensions. The two sides of the ridge post are thus 3.35 m and 2.9 m respectively, giving a total house width of 6.25 m.

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Fig. 25. Area III. House floor, 20 February 1987. View to north.

Fig. 26. Area III. South-east corner of house showing ridge post (foreground) and double line of posts beyond, 11 February 1987. View to east.

A large posthole at the north end of Area III may possibly have been the centre front ridge post. Posthole 1 on Fig. 24 is more than a metre forward of the end of the east side wall represented by postholes 10, 11 and 12. A problem here is that with the possible exceptions of postholes 23 and 28 there are no apparent candidates for intermediate posts to support the 11.6 m span. Also, if this was the ridge post then the house narrowed slightly to the front.

Charcoal and charred post butts show clearly that the house was burnt down, thus sharing the fate of many if not most dry and highly combustible Maori dwellings of timber and thatch. Fig. 24 shows identified post and stake timbers, with details given in Table 7 of charcoal or fragments of unburnt post butt which survived. Kauri was the preferred building timber, with totara, hinau or pokaka (*Elaeocarpus* sp.) and matai also used for house timbers. Other post and stake timbers not part of the house itself are matai, manuka/kanuka, kauri, rimu (*Dacrydium cupressinum*) and totara.

The rear wall of the house was centred on the massive ridge post which was very much larger than any other post in Area III. Much of the butt survived, although decayed (Fig. 27). It was charred at the top, which was the former ground level. East of the ridge post was a double line of posts to the south-east corner of the house (see Fig. 26). Behind the two posts exposed to the interior of the house, presumably the main structural posts, was a line of three further posts most likely designed to hold in place the thatch insulation. This feature was absent on the other side of the ridge post. Immediately behind the ridge post was a further small post, possibly part of the house

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Fig. 27. Area III. House ridge post, 17 February 1987. View to south.

structure, and behind this was a horizontal slab of charcoal. Across the excavated area outside the rear wall of the house was a sand deposit 100-250 mm in depth (see Fig. 23), almost certainly designed to act as a soak or drain to prevent water seepage through the wall to the house floor.

The side wall has thirteen posts between the south-east corner of the house and the group of three which I have suggested marks the front end of the wall. Gaps between posts varies between 980 mm (postholes 16, 17, Fig. 24) and 360 mm (postholes 40, 41). There is, however, a regular measurement of approximately 850-900 mm along the length of the wall, with two additional posts (38, 40) interposed between 37-39 and 39-41. These regular distances all fall between 980 mm (postholes 16, 17), and 820 mm (15, 16) except towards the south end where the gaps from 46 to 48, and 41 to 42 are smaller at 760 mm and 640 mm respectively. The generally regular gaps confirm the identification of this as a house wall.

The wall is straight except at the north end where it bends slightly inwards. This may mark the change from house interior to porch. If so then the interior is 8.7 m in length and the porch 1.8 m deep.

At the north end of the excavated area are the remains of upwards of ten hangi scoops. These clearly have been dug into the earlier house floor and adjacent trodden surface at the front of the building. Hangi stones were found in some scoops which varied from 60-80 mm to more than 400 mm deep.

At the west side of Area III was a discontinuous and thin layer of shell midden, some of which contained lenses of loose grey sand. This consisted mostly of pipi with smaller numbers of cockle and mussel (*Perna canaliculus*), *Cominella* and *Cookia*. Occasional fishbone were mostly too fragmentary for identification; of bone which could be identified 90% was snapper and the remainder eagle ray vertebrae. Two kauri gum 'pebbles' were found in squares D1 and I7. One hinau seed fragment came from C4.

Mammal bone recovered from Area III included dog, which was mostly in the vicinity of an isolated patch of loose shallow shell midden 3-4 m north of the rear wall ridge post (marked 'A' in Fig. 23). From here came a dog rib, left and right tibias, a right radius, three or four phalanges, a cervical vertebra, two jaw pieces and a piece of skull. From elsewhere along the west side of Area III came a dog femur, left tibia and some fragmentary teeth and mandible fragments. Two very fragmentary pieces of massive bone were tentatively identified as whale. Finally, from the extreme north-west corner of the excavation, in the area dug over for cooking, was a single right lower molar of a juvenile (ca. 6 months old) pig.

A large part of the mammal bone listed above was found trodden into the occupation surface associated with the house. In the same situation was other bone which suggests that this may have been no ordinary scatter of food waste. Fragments of human bone were found trodden firmly into the compacted surface of the former house floor. An analysis of this material was carried out by Elizabeth Hudson of the Anthropology Department, University of Auckland, to whom I am indebted for the following information.

The least fragmentary material came from two confined areas near the centre of the house. In square D7 (Fig. 23) were found a left maxilla (upper jaw bone), part of an axis (second cervical vertebra) and parts of the right side occipital and parietal cranial bones in addition to other extremely fragmentary cranial bone. Those bones which do give an indication as to age suggest a youthful individual of perhaps 11-12 years. In the adjacent square E7 was the proximal end of a left tibia, and less certainly identified, an atlas fragment. From square E8 came a possible ulna fragment.

From squares G7 and 8 came maxilla and cranial bone pieces, and a possible vertebra fragment; also a mandible (jaw bone) fragment that from the evidence of an associated unerupted deciduous molar tooth was identified as belonging to a child of 18 months or two years of age. A fibula fragment was identified as probably coming from an adult male. Other pieces of human bone included a tooth (first lower right premolar) from square C3 and fragments which might have been pieces of finger bone (B11).

Burials

Two human burials were found during the excavation of Area III (see Fig. 23). Both graves were dug from the surface below the silt and rock flour and so date from the period after abandonment of the Raupa settlement some time in the 1820s or early 1830s and before the late 19th century mining and deforestation upstream.

Burial 1 was located at the south-west corner of the excavation area. The trussed remains were lying on the left side, orientated east-west and facing just east of north. The remains of the body were found at 300-400 mm depth at the bottom of a shallow pit *ca.* 900 x 800 mm in plan. The burial itself took up an area of *ca.* 725 x 425 mm. The body had its knees drawn up to the chest with arms at the side and hands apparently placed on the knees. A brief examination during excavation suggested that this individual may have been a child or young person of 11-13 years.

Soil immediately below the remains was strongly stained with ochre. On top were the fragmentary remains of several parallel wooden planks laid east-west along the length of the body. The planks were not part of a coffin but were simply laid on top of the interred remains.

The second burial (Burial 2 in Fig. 23) was very different. Near the north-east corner of the excavated area was uncovered a small pit *ca.* 900 x 700 mm in plan and 350-600 mm deep. In it was a secondary human burial with partly disarticulated bones carefully placed in a neat pile *ca.* 600 x 400 mm in plan. Here the skull was at the east end of the remains opposite to the situation at Burial 1, but as in the other example the head had been turned to face north. The remainder of the upper part of the body lay on its back, with the two femurs laid on top, parallel to the backbone in an east-west orientation. Some ochre and quantities of charcoal were associated with the remains which were more fragile than those of Burial 1. The massive bones show this to have been an adult, in all probability male.

Patu onewa

A patu blade (Fig. 40) was found in two pieces at the east side of Area III. The larger part came from square J10 and the smaller from J6 some 4-5 m away. The fragments fitted together to make up the 117 x 109 mm, 19 mm deep, blade end of a well finished weapon in green Waiheke Group greywacke. The larger piece shows signs of having been subject to heat and the shape of the break itself suggests fire and not breakage as a result of being struck. In this respect it is interesting that the patu was found close to the east wall of the house; it once may have been hidden in the thick raupo wall and have been destroyed in the fire that consumed the building.

Nephrite

From metre square D2, among the hangi scoops at the north-west corner of Area III came a tiny (9 x 6 mm) piece of nephrite jade. Polish on one flat side suggests that it was once part of an adze or chisel.

Bone artefacts

Bone artefacts recovered from Area III were a fragment of bird spear (Fig. 48) and fishhook point fragment (Fig. 45). The former was found in square 17 associated with the house floor surface. It is 50 mm long and although not charred on the surface is brittle as though having been in a fire. The 15 mm fishhook point (from J7) probably comes from a two-piece bait hook of the type called by Fisher (1935:294-297) the 'Oruarangi point'.

Obsidian

A total of 1077 pieces of obsidian weighing 6071.5 g were recovered from Area III. This was recorded on excavation as having come mostly from Layers 1 and 2 with some material from disturbed surface silt and some from Layer 3. It is, however, not possible to assign the various layers to different occupation periods and for the purpose of the following discussion all obsidian is combined (see Fig. 28).

Distribution was concentrated over the central part of the excavated area. More than half the material by weight (52%) came from only 25 (of 107) one metre squares extending from C3 and C8 to J7 and I10. South of this was an area of very little obsidian, the weight from 25 m² here being only 5.2% of the Area III total. The north-east corner also has little obsidian although this results partly from J1-2 not being fully excavated.

Some aspects of the distribution may relate to the house that stood here. At or near the wall at the centre of both sides are metre squares with comparatively large quantities of stone (C3-6, C8 and I7-10, J7-8) which may indicate storage along the walls or perhaps clearing the house floor of sharp flakes. Adjacent unexcavated areas east and west would need to be looked at to see if the house walls do indeed confine the stone and the activities represented. Immediately to the rear of the house are several squares (D-I13) with no obsidian or very little, suggesting that to some extent at least the rear wall confined the activities represented. A large (271.1 g) core piece of very high quality stone in C13 may have come from the rear wall itself.

		D E F G H I J						
1	C	18	5	7	3	5	8	2
		48.4	74.3	30.6	43.7	6.8	39.4	6.8
2	C	20	18	13	29	16	1	5
		48.6	97.7	98.4	62.7	64.1	3.6	4.2
3	3	27	9	11	13	12	4	5
		117.2	38.3	58.8	33.9	42.4	13.9	22.5
4	4	22	9	15	15	10	12	14
		67.2	48.2	74.2	106.4	88.4	61.0	64.8
5	5	29	7	18	14	3	3	16
		469.9	9.1	148.0	67.0	20.2	2.1	60.3
6	B	30	2	7	32	8	6	21
		96.9	22.9	81.5	197.6	55.5	57.3	31.6
7	7	4	3	3	11	13	8	17
		10.0	14.0	27.3	56.2	60.1	78.0	55.7
8	8	4	10		5	29	10	16
		33.2	135.4		22.2	179.6	20.2	56.0
9	9	5	2	5	37	7	3	20
		26.1	13.2	38.9	281.6	10.3	45.3	41.0
10	10	4		3	2		8	6
		27.6		26.7	3.1		7.7	19.4
11	A	5	5	1	2	2	5	11
		50.6	38.6	23.9	2.7	1.3	13.3	6.7
12	12	1	5	5	3	7	12	7
		4.2	55.2	18.6	10.1	15.8	74.6	57.6
13	13	2	2		1			4
		64.8	274.4		13.8			8.3

Fig. 28. Area III. Obsidian distribution. In each metre square is given number of pieces and total weight. 'W' refers to material identified as having come from the Waihi source, 'G' refers to pale grey obsidian.

As in other parts of the site the vast majority of obsidian in Area III is green in transmitted light, and almost certainly originates in Mayor I. Seventeen pieces of total weight 155.2 g (2.56% of the Area III total) are grey. Several of these have been identified by Moore as having come from the Waimata Stream (Waihi) source (Moore & Coster 1989), five being positively identified and another five being possibly from that source. Seven small pieces Moore does not assign to any particular source although some of these also may be from Waimata Stream if we are to judge from their similar location: Waihi and unidentified grey obsidian alike are largely confined to the south-east parts of the site (see Fig. 28). A group of four pieces identified as possibly having come from the Waimata Stream source retain areas of cortex. This is in marked contrast to the Mayor I pieces less than 1% of which have original cortex from flow margins or subsequent beach boulders.

Sixty-five obsidian pieces weigh more than 20 g. The remainder of the material can be briefly summarised as follows: 0-1 g 40.6% of pieces; 1-5 g 36.2%; 5-10 g 9.7%; 10-20 g 7.4% and more than 20 g 6.0%. Few of the pieces smaller than 5 g show signs of deliberate preparation or of subsequent use. Even some of the largest pieces show no sign of having been used as tools. While it is often difficult to be sure of deliberate fashioning of obsidian tools, examination of the Area III material suggests that approximately 20% may be deliberately made flakes or are pieces from which flakes have been struck. Only 107 pieces (9.9%), however, have been identified from edge damage as having been used as tools, probably in the working of fibre or wood.

Chert

From Area III came 462 pieces of chert of a total 3558.5 g weight. Like obsidian the material is treated here as belonging to the single Area III occupation period which relates to the house floor and area immediately surrounding (see Fig. 29).

More than 83% of pieces, 64.4% by weight, were recovered from only 27 m² (HIJ 4-13) at the east side of the excavation. Of the remaining three-quarters of Area III a handful of large pieces in only three squares (D, E and G2) contributed 69% of the total weight. There is thus a very marked concentration of chert along the east side of Area III, especially at the south end where from only 6 m² (HI10-12) came more than half the total number of pieces. To some extent this is similar to the situation with obsidian where it was suggested that the concentration at or near the house walls reflects the habit of storing stone material here or perhaps sweeping clear the house floor. It may also reflect, more simply, the location of work areas where chert was struck off blocks to form useful sharp flakes or where the flakes themselves were used in a variety of cutting or scraping activities.

The range of cherts from Area III is very wide. As in other areas much the most abundant material is white, cream or pale yellow ochre in colour but with some pink or red. Many pieces display white cortex. This chert made up the greater part of the heavy concentration at the south-east corner as well as being common elsewhere. Other cherts include a variety of greys, blue grey and brown, often of high quality fine-grained material. Dark red chert and poor quality jasperoid stone are also represented as are brown and white chalcedonies. It is highly likely that most or all of the chert came from the nearby Coromandel Ranges and peninsula.

		D	E	F	G	H	I	J
1	C	2 4.3	2 11.0	3 45.6		1 1.3		
		4 116.4	4 452.6	1 1.2	4 302.6			
3	B	2 3.4	1 12.2	2 7.8	1 14.8			
4		2 1.2		1 7.0	2 9.7	2 11.9	2 18.3	6 44.9
5		3 0.7		4 73.5		1 141.5	3 1.3	10 134.5
6		1 1.6					4 25.3	8 45.8
7	A			1 0.1	1 1.7	6 192.1	2 4.2	4 16.5
8				5 19.0	8 11.5	11 56.2	6 8.7	6 9.4
9		1 93.2	2 10.8	2 4.1	3 0.5	6 12.3	12 21.9	10 64.7
10		1 11.7			1 1.9	29 85.8	14 40.5	10 33.8
11	A	1 6.6	1 4.1	1 1.9	4 14.9	1 4.1	40 88.4	15 115.7
12				1 0.8		2 2.3	63 580.3	80 432.2
13			2 9.4				8 56.7	24 35.8

Fig. 29. Area III. Chert distribution. In each metre square is given number of pieces and total weight.

The great majority of individual pieces of chert are very small, being less than 5 g, and in many cases less than 1 g, weight. Eight pieces which together total 1608.0 g make up 45% of the total weight of stone. One of these pieces from metre square B9 is of high quality brown chert with some chalcedonic mottling and red and white cortex. This item fits well to the hand and displays considerable damage on two sharp edges. The other seven large pieces are all off-white with occasional pink and yellow colouration.

Almost all of the chert is waste, much of it shattered from cores or blocks of the most abundant pale, predominantly white or off-white stone. From a few square metres at the south-east corner came as many as 60 mostly small pieces, all apparently struck or shattered from the same piece of this stone. Many smaller groups of material from one parent block were found in other parts of Area III. Edge damage of sharp flakes to indicate use was rare. Only eight pieces displayed unequivocal damage through use as a tool, while another nine may have been damaged through use. Thus while 10% of Area III obsidian flakes show signs of use, only 1.7-3.7% of chert pieces were used as tools.

Kokowai

Throughout Area III and neighbouring Area IV, were found innumerable tiny pieces of ochre. Almost all was in the form of fragments of haematite raw material; some pieces may have been processed by grinding and mixing with shark oil. The abundance of ochre fragments in the Raupa site indicates much use of this material, probably to embellish architecture and portable wood carving, to colour cloaks and other clothing and to smear the body.

A few pieces of stone were used for ochre grinding. In metre square J8 was found a smooth water-rolled stone *ca.* 115 x 105 x 65 mm of fine-grained green Waiheke Group greywacke with areas of ochre over the surface. Another water-rolled stone, from E7, also has ochre on its smooth surface. This elongated stone measures 160 x 50 x 37 mm. Interestingly it also has some 'chatter' marks from use as a hammerstone and there has been a slight notch pecked out of one narrow side.

Among the large numbers of hangi and other waste stones piled along the sides of the Area III excavations one fragment was found to have ochre on it. The item was found at the south end of the excavation area. It measures 130 x 50 mm and 20 mm deep and is broken off a once larger piece. A natural flat surface of the angular rock is covered in wine red ochre.

A stone for which excavation records have been lost also probably belongs with Area III material. This stone is a fragment of a larger piece, flat-sided as a result of flaggy geological structure, measuring 160 x 60 mm and 45 mm deep. One side is covered in pale red ochre, with a small area subsequently ground clean of colour. On the other side are parallel marks of deeply scored grinding, with a patch of red and black pigment at one end.

From square I13 (see Fig. 23) came two fitting fragments of a haematite of igneous origin, mostly of deep wine red colour but weathered to soft brick red on one side. The joined size of the two pieces is *ca.* 53 x 25 x 12 mm. The material is of a quality and colour to make excellent kokowai. Interestingly the combined piece has been ground on one surface into a concave dish possibly as a result of being rubbed directly on to an object for colour.

Other stone

In addition to stone material dealt with in the above paragraphs, miscellaneous items recovered from Area III included quartz, petrified wood, greywacke, argillite, pumice and ignimbrite. The quartz item, (from square D1), is an 8.5 g piece of crumbly crystal aggregate — like similar material from Area I, it was possibly brought in as an abrasive. Three pieces of petrified wood are of identical cream and red material to that described from Area I. All three came from the east side of Area III (G12, 15 and J12) and together weigh 237.5 g, two of them being of suitable shape for further fashioning into lure shanks.

As with other parts of the Raupa site, Area III was found to include natural fragments of pumice, mostly small and water-rolled to a rounded shape. One large piece *ca.* 100 x 65 x 35 mm from the house back wall (E12) is black with charcoal and has been heavily used on one flat surface as a polishing stone.

A group of waste greywacke or argillite pieces mostly result from the fire shattering of oven stones. Unlike the vast majority of such pieces from Area III, originating in the northern and eastern parts of the excavation, the retained pieces are of fine-grained stone, mostly of adze making quality and occasionally exhibiting conchoidal fractures. Two pieces of fine-grained grey-green argillite from squares H8 and G11 are similar enough to have come from the same water-rolled stone. Both have conchoidal fractures and may have been deliberately struck. A large fire shattered piece from a water-rolled green greywacke boulder (I9) has had one blunt edge used as a crude cutting or grinding tool. Other waste from adze quality material includes a small flake of very fine-grained greywacke from F7. More unusual is a fragment of soft black argillaceous material, possibly graphite, which may be the result of deliberate flaking. It was found at the house back wall in square E12.

Material of European origin

Some very rusty fragments of iron, a piece of window glass and the remains of a tin matchbox make up the material of European origin recovered from Area III. The highly degraded, *ca.* 70 x 40 x 26 mm, matchbox came from the surface silt and disturbed soil (Layer 1) in square J2. It is embossed “BRYANT & MAY/WAX VESTAS/LONDON”, and is identical to the box illustrated by Bedford (1958:54 and 58 top left) which is a type dated to *ca.* 1880. Four other fragments of completely rusted iron may have been pieces of wire or nails. All came from the surface layers of the site. The only piece of glass came from J8, Layer 1, and comprises a tiny fragment of thin colourless window glass.

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Fig. 30. Areas III and IV, 20 February 1987. View to north.

AREA IV (Figs. 2,30-33)

The 5 x 5 m Area IV excavation was opened up 5 m north of Area III. The same grid line laid out at 345° provided the east side of Area III and the west side of Area IV (see Figs. 2,30). Unlike the former, Area IV was excavated throughout to the bottom of the occupation material.

Stratigraphy

Area IV was excavated to a maximum of almost 1 m depth, most of the square finishing at *ca.* 600 mm. Within this were deep blocks of relatively indifferntiated fill, Layers 2, 4 (Fig. 31).

- Layer 1. Fine yellow mine tailings and yellow-brown water-laid silt extended over the whole square to a depth of 50-80 mm.
- Layer 2. Mottled and crumbly chocolate brown loam, 180-300 mm depth. This layer contained plentiful hangi stones, especially at lower levels, also large quantities of obsidian, less of chert, much fine ochre throughout, and charcoal which was abundant in places.

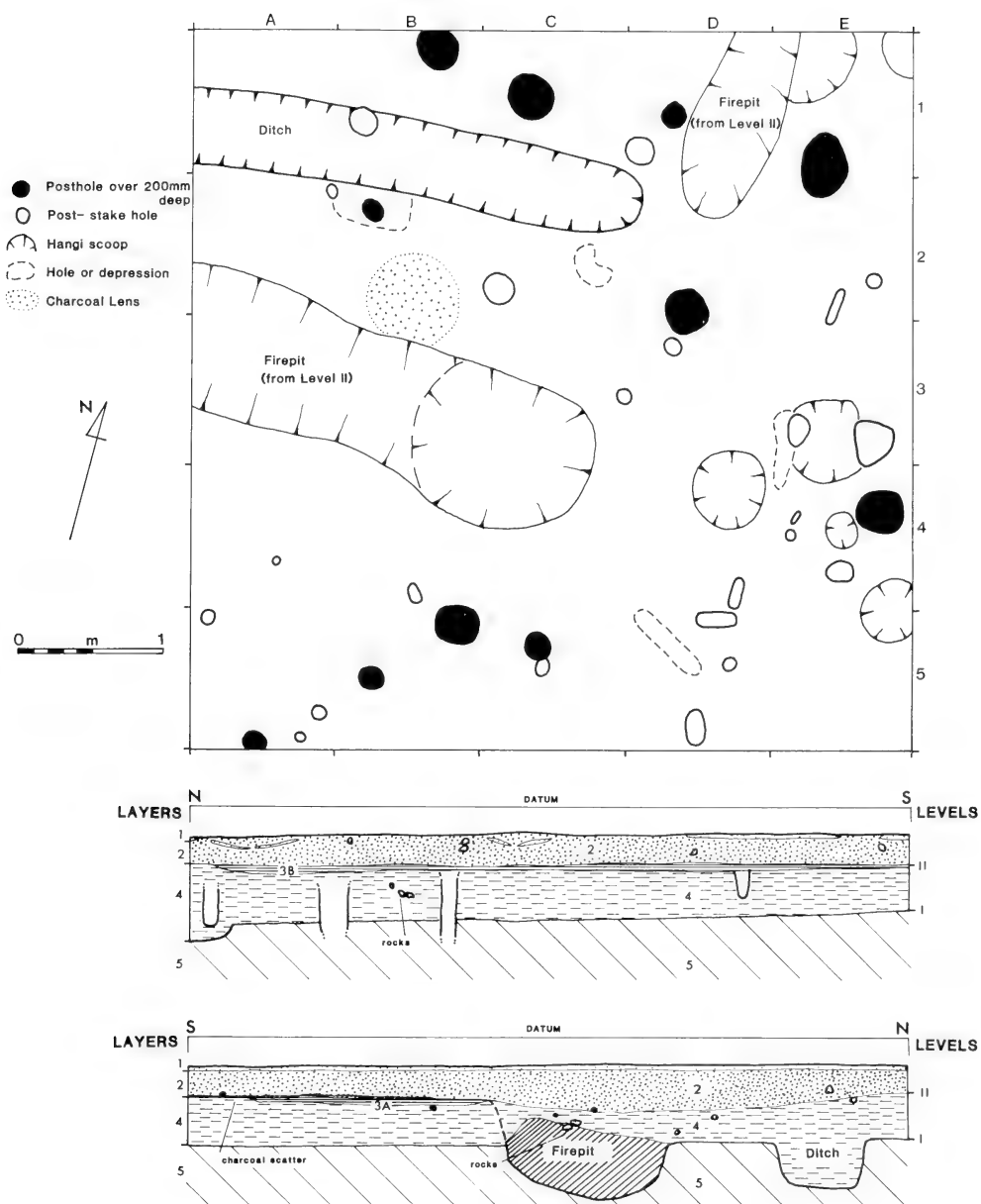


Fig. 31. Area IV. Level I plan and east and west stratigraphical sections. Layer descriptions in text.

- Layer 3. A variable occupation surface extended over the whole square, being especially distinct in the south-west corner and along the east side (see Fig. 32). In the south-west corner Layer 3A comprised a compacted surface identical to the adjacent Area III house floor and the hard surface in front of the house. Here the compacted layer was 60-80 mm deep with extensive areas of charcoal. At the east side of the square Layer 3B took the form of pale silty sand, 40-100 mm in depth (Fig. 31, east section) and extending 1.5-2 m from the baulk. Here there were many broken oven stones, especially at the north of the square, numerous obsidian and chert flakes and other cultural material.
- Layer 4. A homogenous grey/brown silt loam, 200-600 mm in depth. This layer contained some obsidian and chert material and rare hangi stones.
- Layer 5. Yellow clay natural base of the site.

The occupation sequence

At Area IV are two major occupation periods, almost certainly interrupted by an episode of flooding which deposited a large quantity of silt over this part of the site. Following the later occupation period a second major flooding episode again covered Raupa in silt. Following this there was sufficient time for a well structured loamy soil to develop before being in turn buried by the rock flour and silt of the late 19th and early 20th century.

Level I. Dug into the natural clay base of the site were several postholes, a 300 mm deep ditch and some shallow scooped depressions (see Fig. 31). Two firepits penetrated the natural from the top of Layer 3, and are thus part of the Level II occupation. There was little artefactual material associated with Level I except for some obsidian and chert pieces (Layer 4 in Tables 8, 9), innumerable tiny fragments of red ochre and occasional oven stones.

There are some interesting aspects of the Level I posthole pattern. At the north-east and south-west corners of the square are strong lines of comparatively deep post holes. These are not straight, so that they suggest internal fences or palisades rather than the walls of a house or other roofed structure. Some elongated slots of postholes extend from the south baulk 3 m up the east side of the square. These indicate the use of planks and probably make up part of the wall of a roofed building which to judge from the use of dressed timber, may have been a sleeping house or dwelling rather than a cooking shed or other less formal building.

The purpose of the ditch running into the baulk at the north-west corner is not clear. In a low lying site such as Raupa ditches may occasionally have been dug to clear surface water. In any event the evidence of Level I occupation here was soon to be buried by the Layer 4 silt, which, judging by the homogeneous nature of the material may have resulted from a single flooding episode. On top is evidence of the second occupation period.

Level II. The second occupation period at Area IV (Fig. 32) is contemporary with construction and use of the Area III house. At the south-east corner of the square was found the edge of the compacted surface which extended in the adjacent square across the front and into the house. A confined area of fired stones and charcoal on this surface must relate to an event late in the second occupation period.

Two deep pits dug from the surface of Layer 3 through Layer 4 into the basal clay contained plentiful hangi stones, charcoal and ash. Lenses within the pits indicate repeated re-use. Although unusually shaped for hangi pits these were in all probability used for cooking. From the bottom of the large Firepit 1 came some massive pieces of charcoal and charred timber identified as kauri. At the top of Firepit 2 was found the charcoal remains of totara.

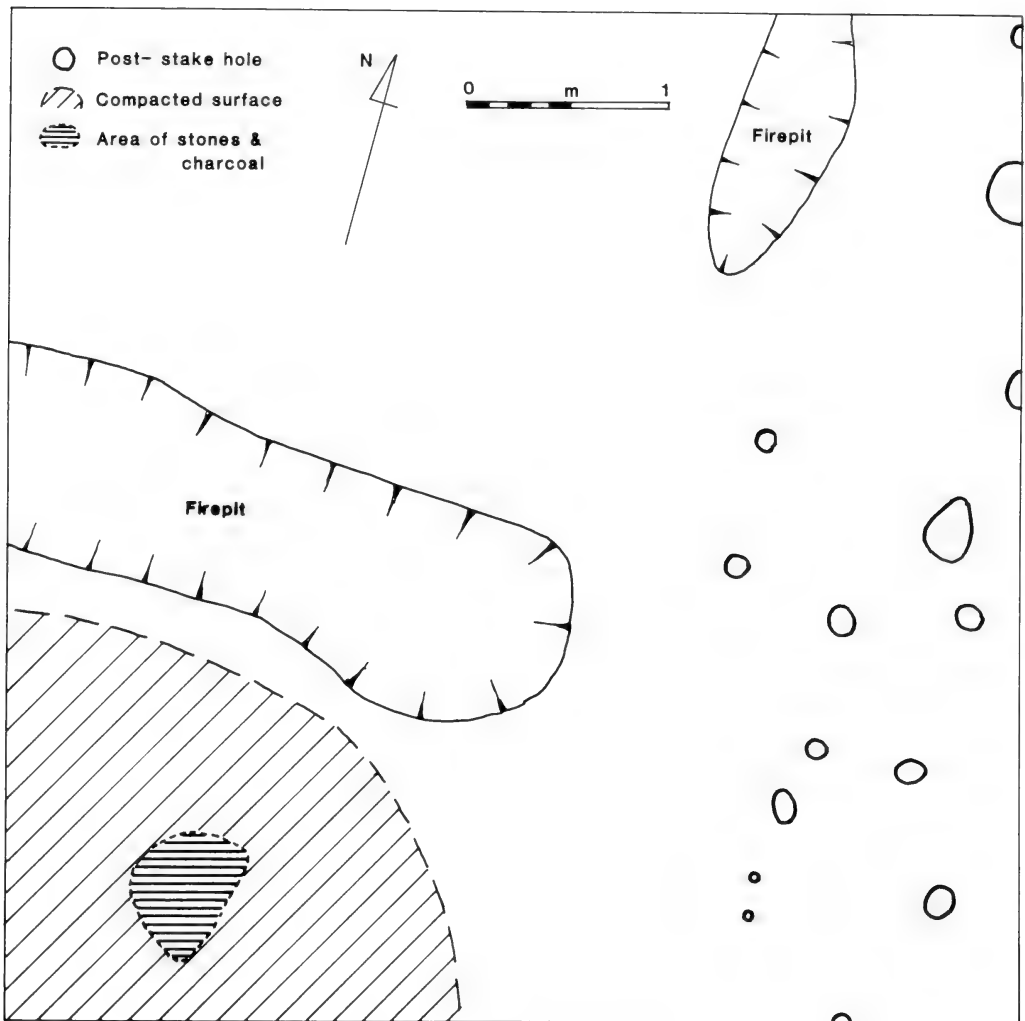


Fig. 32. Area IV. Level II plan.

At the east side of the square are a number of post and stake holes which indicate a light shed or fencing here. Everywhere throughout Area IV were tiny fragments of ochre to show a considerable use of this decorative material. Two fragments of highly degraded kauri gum were recovered from squares D-E2, Layer 3.

Bone and shell was very rare and mostly fragmentary. From the firepit fill came the mandible of a young dog (metre square C3), and what are probably whalebone fragments (C4). A second dog mandible was found in E2. One human tooth was recovered in B3. Three other bone fragments could not be identified. Fish were represented by one snapper tooth and shells by a bivalve fragment, the epidermis of a green mussel and two unidentifiable pieces.

Adzes

One complete adze, a half adze and a polished fragment were found in Area IV. The complete item came from Layer 3B, square E1 (Fig. 36). It measures 114 x 33-61 mm and is approximately 25 mm deep. The cross-section is sub-rectangular with comparatively sharp edges. The finish is polish over flake scars and hammer-dressing. The well-defined bevel has been subject to regrinding and the polished butt shows slight haft-polish. The raw material is a fine-grained green greywacke, probably of Waiheke Group stone.

The blade half of a rectangular cross-sectioned adze was recovered from metre square B3, like the complete adze it was from the Layer 3 occupation surface. What remains measures 95 x 55 mm and 26 mm deep, the complete adze may have been 150 mm long. The adze is roughly broken to indicate the comparatively poor quality of the coarse-grained green greywacke, again probably originating from among Waiheke Group material. The battered blade shows signs of heavy use. The original adze was probably polished throughout over hammer-dressing. It has been subject to heat possibly before breaking or, perhaps more likely, the heat of a fire itself causing the break.

In square B1, Layer 2, was found a 22 x 15 mm fragment of a highly polished adze in fine-grained dark grey greywacke. Parts of three polished surfaces, the bulb of percussion of the fragment itself and the pattern of previous flaking all suggest that the flake came from the blade end of an adze which was being reworked, possibly following accidental damage.

Patu muka

Fragments of two patu muka, both from Layer 2, were found in Area IV. From metre square D5 came a well-finished handle (Fig. 41) 115 mm in length, oval in cross-section at the butt end and almost circular at the break. At the butt end can be seen the original surface of the elongated water-rolled stone used for this pounder. The raw material is a pale green igneous rock.

The second item, from C2 (Fig. 42), is the working end of a pounder 105 x 89 mm and as much as 40-55 mm deep. The original stone surface can be seen on the two larger sides; the narrow sides and the end have been fashioned by hammer-dressing.

The minimal work done to form a *patu muka* from a stone of approximately the right shape is reminiscent of a number of Oruarangi examples. The raw material is a coarse grey andesite.

Incised stone

Fig. 44 depicts a most unusual item from square D2, Layer 3. A broken fragment of very fine-grained sandstone *hoanga* (grindstone) measures *ca.* 80 x 75 x 40 mm. On the slightly concave (ground) surface of one side has been roughly scratched a design which includes an open spiral and a short length of four curving parallel lines. On the broken back of the stone and along one edge of the grinding surface are areas of red ochre — some ground into the surface, others apparently congealed from drops of 'paint' formed of ochre and shark oil. The latter have the appearance of dried blood, but testing was negative for blood and prepared ochre paint seems most likely. Within the concave grindstone surface is an area of black pigment into which the design has been scratched.

The stone appears to have undergone several uses. Before it was broken, the originally larger piece was used as a fine grindstone on two facets at least. Some ochre grinding may have been carried out. The design on the remaining fragment is similar to a male tattoo design on the nose, upper cheek or chin (cf. Simmons 1986:26), and may thus have been a sketch carried out by a tattoo artist. The black colour may be the remains of tattoo pigment placed on the stone surface for the tattooist's use, or rubbed onto it in the course of resharpening tattoo chisels.

Pumice

The most important pumice item found in the 1987 Raupa excavations was recovered from metre square C3 at the bottom of the firepit dug from Level II. A well made pot (Fig. 43) was fashioned from a rounded piece of highly vesicular pumice. The hollowed-out interior is approximately 27 mm deep and 24-25 mm across at the lip. There are no residues to indicate what this pot was used for, indeed the interior is so clean that it does not appear to have been used at all. A tiny piece of ochre adhering to the outside only reflects the abundance of ochre fragments throughout Area IV.

Another piece of pumice *ca.* 65 x 45 x 28 mm in size, from the Level II surface, D2, has one side markedly dished, with four small holes within the concavity suggesting that it may represent an early stage of manufacture into a small pot. Alternatively, and perhaps more likely, the concavity and holes are the natural result of erosion of a soft part of the water-rolled pumice pebble. Approximately ten other small pumice fragments from Layers 1-3 are unmodified and were in all probability naturally deposited during periodic episodes of flooding.

Kokowai

The very large number of tiny pieces of *kokowai* in Areas III and IV has already been remarked upon. Two items relating to this are grindstones of flaggy ignimbrite with traces of ochre ground into the flat surfaces. Both are fragments broken from once larger pieces. One (B3, Layer 3) measures *ca.* 140 x 65 mm and 20 mm through,

with both flat sides extensively coloured with ochre. The other (B4, Layer 3) is triangular in shape *ca.* 80 x 60 mm and 37 mm deep. This piece retains only very faint traces of ochre and has been used for grinding not just on the flaggy surfaces but on a rough break as well as at two right-angled edges.

Obsidian

In Area IV was the greatest obsidian density of any of the excavated parts of the Raupa site. A total of 663 pieces weighed 4205.1 g, an average of 168 g per m². More than 77% of material by weight came from Layers 2 and 3, the Level II occupation which relates directly to the Area III house floor. Some material assigned to Layer 4 during excavation may also belong to the Level II occupation, especially in metre squares A2, A3 and B3 where comparatively large quantities of material for Layer 4 are shown in Table 8.

The predominance of very small pieces was even more marked than in Area III. Approximately 76% were less than 5 g in weight, 48% of the total less than 1 g. Of the remainder, 9.0% were 5-10 g, 7.7% 10-20 g and 7.3 % more than 20 g. The heaviest piece was a 196.4 g core extensively reduced by flaking which came from the Level II surface in C3. Of four other pieces which weighed more than 100 g, three belong to a single cache from metre square D2 (Fig. 33).

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Fig. 33. Area IV. Obsidian cache (metre square D2), 4 February 1987.

Almost all the obsidian is green in transmitted light and probably originates in Mayor I. Notable among the remainder is material identified as coming from the Waimata Stream, Waihi, source. Eight pieces weigh 173.2 g — 4.12% of the total Area IV obsidian. An additional 1.5 g fragment of comparatively black material from C5, Layer 2, is identified as possibly being from Waihi. Except for two small pieces from Layer 4, B2, all eight positively identified pieces come from Layer 3, that is, the Level II occupation surface. Among these are two cores from A3 (81.1 g) and C4 (64.7 g), both with areas of cortex and both illustrating repeated removal of flakes from the high quality opaque grey-green stone. A much smaller piece from E5 weighing only 8.3 g also appears to be a core remnant. None of the Waihi items show any sign of edge damage.

One 6.3 g piece from C5, top of Layer 4, is identified as possibly having come from the Whangamata source (see Fig. 1). There is a suggestion of edge damage at one margin of this well made flake. Other non-Mayor I material includes a good quality highly translucent grey obsidian of which six pieces, 21.0 g total, were found in D5, two pieces, 6.5 g, from E4, and one weighing only 0.1 g from square C3, all of them from Layer 3. Possible sources of this material include Taupo and Great Barrier I. Another three pieces of high quality black obsidian from D1, B3 and B4 total only 3.8 g in weight. The source is unknown. Material almost certainly from Mayor I makes up all the remainder, approximately 94.5% of the total by weight.

As Table 8 shows, more than 80% of Level II obsidian came from only nine metre squares: E1, D2, B-C3, C-D4, C-E5. There may also be a problem with the layer attribution of A2-3 and B3 material which suggests heavier concentrations of Layer 3 obsidian than is given in the Table. There is thus no marked concentration of distribution to suggest activity or working areas within the 25 m². A concentration of chert in the south-east corner of Area IV is to some extent reflected with obsidian but the latter is also abundant in the centre, west and north-east of the excavation area.

Notable was a cache of nine large, seven small and two tiny fragments of Mayor I obsidian from metre square D2 (Fig. 33). The cache weighed 771.5 g in total. It came from a part of Area IV where there was a large number of fire cracked and other stones on the compacted Level II surface. Among the large pieces which average 77 g, seven display some edge damage. Only two of the smaller pieces (average weight 11 g) show any sign of having been used.

Including the cache items, approximately sixty pieces (*ca.* 9%) show some sign of having been used for cutting or scraping. Most of the edge damage is on straight edges to indicate use as a knife; a very few items are damaged within a notch or curve suggestive of operation as a spokeshave.

Chert

A total of 126 pieces of chert weighing 1736.1 g was recovered from Area IV. As with obsidian some chert was found in the uppermost disturbed layer, including one 420.0 g piece of coarse-grained off-white and yellow material from metre square D4 which lifted the total Layer 1 weight close to the Layers 2 and 3 figure (see Table 9).

Table 8. Area IV obsidian distribution, from 663 pieces of 4205.1 grams.

Square	Layer 1		Layers 2, 3		Layer 4	
	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).
A1	3	3.8	13	43.2	6	7.6
B1	2	4.2	9	13.4	1	2.8
C1	14	21.2	10	3.7	1	1.1
D1	1	1.6	20	66.6	1	13.7
E1			29	140.8		
A2	1	18.1	16	63.1	11	126.5
B2	1	2.1	13	22.4	2	1.1
C2	2	14.5	4	11.4		
D2	2	18.9	31	797.2*		
E2	13	17.2	21	27.9	4	11.2
A3	2	13.9	3	85.1	23	96.6
B3	1	1.4	26	337.4	29	313.0
C3	3	0.8	28	163.9	13	38.8
D3	2	16.5	20	42.7	1	0.5
E3	2	0.9	9	50.9		
A4	2	9.7	4	20.1		
B4	3	2.5	8	29.4		
C4	9	62.3	41	513.9	2	13.3
D4	6	15.8	19	176.5		
E4	9	23.5	26	48.9		
A4			4	8.7		
B5	2	49.9	20	84.9		
C5	5	13.1	64	208.9	1	6.3
D5	3	3.5	33	163.6	1	4.8
E5	2	0.7	31	125.3	2	1.8
	90	316.1	502	3249.9	98	639.1

* Includes cache of 771.5 g

More than 60% of all chert by weight came from just four square metres (D-E4, C-D5) at the south-east corner of Area IV (Table 9). Among this, however, was a substantial quantity found in Layer 1 which was made up of silt and disturbed soil, so that we cannot be sure where the chert originated, or in some cases, if it is even cultural in origin. Of the Layers 2 and 3 material, most or all of which relates to the Level II occupation, 71% of chert was found in only 6 m² at the south-east corner of the excavated area (CDE 4 and 5). The same six metre squares also produced above average quantities of obsidian which does suggest that here there was a work area related to the use of sharp cutting tools, or the preparation of those tools.

Table 9. Area IV chert distribution, from 126 pieces of 1736.1 grams.

Square	Layer 1		Layers 2, 3		Layer 4	
	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).
A1			2	5.2	2	38.2
B1	1	1.9	2	3.4	1	1.0
C1	1	2.3			2	2.5
D1			2	12.7	1	2.3
E1			1	0.6	2	20.0
A2			5	64.2	1	43.4
B2			1	3.3	1	8.5
C2	2	0.6				
D2					3	20.0
E2			7	7.9	1	11.0
A3			1	5.5	1	0.3
B3			3	38.9		
C3			4	25.3	1	0.5
D3	2	31.4			2	117.8
E3			6	12.0	2	6.1
A4						
B4			3	25.9		
C4	1	0.6	4	37.8		
D4	3	428.9	5	106.7		
E4	3	43.8	7	113.9		
A5			2	32.9		
B5			3	4.1		
C5	2	100.4	7	130.6		
D5	3	2.0	6	154.2	1	7.1
E5	3	1.7	13	58.7		
	21	613.6	84	843.8	21	278.7

Cherts in Area IV included a range of materials and colours. Most pieces were white or creamy white, sometimes tending to pink, red and yellow ochre in colour, or with a mix of white and these colours. Off-white stone was often coarse-grained and poor quality. Red chert of comparatively poor quality was also present in some quantity. Good quality jasper and white or off-white chalcedonies were recovered as were fine-grained black, grey and brown translucent and opaque cherts.

More than 80% of pieces were waste with no sign of deliberate manufacture or subsequent use. Among other pieces are some worthy of individual notice. From metre square D3, Layer 3 came a *ca.* 55 mm diameter, 25 mm deep, piece fashioned into a hammerstone but not yet used for that purpose. The stone is a banded grey and pale yellow-brown chert. The weight is 112 g. A 71.2 g water-rolled stone of high quality jasper which may have been used as a hammerstone, was found in C5. From D4 Layer 2 came a chunky 60 x 40 x 40 mm core weighing 100 g from which flakes have

been struck on every surface. The chert is red, white and grey with some crystal inclusions. A more interesting core of fine-grained yellow-brown chert with some red cortex was found in A1, Layer 4. It weighs 24.5 g and is 32 mm long and 29 x 22 mm across a cortex platform. From the edge of the platform successive flakes have been struck to reduce the core to its present remnant, almost too small for further successful use. While the D4 core resulted from flakes struck from its entire available surface, this core displays the results of flakes carefully taken off from the platform circumference only.

Used flakes include some interesting pieces. A coarse-grained pink-brown chert 35 x 25 x 16 mm has been ground at a sharp edge indicating use as a 'cutter' or 'saw' (E4, Layer 2). From the same location is a 28 mm long fine-grained red-brown chert flake that shows some unifacial edge damage as well as having been polished through use. A similar, 29 x 25 mm and 3.8 g, yellow ochre colour chert flake from E3, Layer 4, also has unifacial edge damage and edges polished smooth through use. From E5, Layer 3B, came a piece of jasper 25 mm in maximum dimension and weighing only 2 g with bi-facial edge damage and polished edges — again a well used piece. These three pieces are very similar in size and shape and in the results of use which appear on their sharp edges. Another twelve pieces of chert also display some unifacial edge damage as a result of use. This includes white-yellow-grey pieces, yellow ochre and pink material and red and white chalcedonies. Most used pieces are small, weighing only a few grams. A further five or six pieces show edge damage which may be the result of use.

Other stone

Among other stone material not already introduced is andesite, petrified wood and ignimbrite. The largest and most unusual group of material is petrified wood. Six pieces include two small fragments of less than a gram and four larger pieces from squares A2 and A3 which together weigh 353.5 g. These were assigned to Layers 1, 2 and the interface of 2 and 3 during excavation, but almost certainly have come from one parent block associated with Level II occupation. A common use of petrified wood was in the manufacture of lure shanks — two or three of the larger pieces from the north-west corner of Area IV are of a size and shape which suggests initial shaping for this purpose. The raw material is cream and pinkish red in colour with one piece carrying a small patch of crushed ochre. A fragment of fine-grained siltstone was possibly used as an abrasive in grinding. From D4 Layer 2 came a tiny piece of pink cellular material which may be organic in origin but for which no identification can be offered.

Material of European origin

The only items of European origin to be found in Area IV were two fragments of bottle glass and flat piece of copper. The bottle glass came from squares A1 and C1 and were assigned to Layers 2 and 1 respectively. The tiny green glass fragments have probably come from two different bottles, one of which may have been of nineteenth century wine bottle type (see, for examples, Prickett 1981:397, 399, 401). The copper piece is slightly concave in shape and 22 x 22 mm in size. It came from the surface layer

of water-laid silt and mine tailings, square D1. Nothing can be said of its purpose. The wine bottle fragment may relate to the Maori occupation of Raupa; the other two items clearly belong to a later, European, period. Two pieces of what looks like coke were found in Layers 1 and 2 in adjacent squares B1 and B2.

AREA V (Figs. 2,34,35)

Area V was first opened up on 21 January but because of other priorities it was 2 February before work began in earnest at this part of the site. Later in the excavation season the focus turned to Area III and work on Area V again suffered from a lack of labour and time. Area V was thus not completely finished but enough was excavated to give a broad outline of the history of this part of the Raupa site. Area V was located 15 m north of IV, with the west side of the new square sharing the same 345° grid line as the east side of Area IV (Fig. 2).

Stratigraphy

Six layers and several lenses of material were identified above the natural base of the site (Layer 7). Layers 1-3 all relate to the period of mining operations up the Karangahake Gorge and as such are contemporary with Area I Layer 2, Area II Layers 2 and 3, Areas III and IV Layer 1.

- Layer 1. Yellow rock flour and silt extended over the whole square to a depth of 25-100 mm.
- Layer 2. A 10-40 mm layer of cream coloured silty clay with very fine horizontal laminations. This probably signals localised episodes of ponding in what is a slight depression in the generally level ground surface.
- Layer 3. More rock flour 30-60 mm in depth.
- Layer 4. Dark brown sandy clay with abundant charcoal, 50-160 mm in depth. Within this layer are patches of rock flour probably brought down as a result of late 19th or early 20th century ploughing. Layer 4 tends darker towards the bottom.
- Layer 5. Midden comprising crushed shell, very rare bone and large quantities of charcoal in a black sandy loam matrix.
- Layer 6. Yellow-brown sandy clay with some pieces of charcoal. The base of the site is 300-600 mm below the present ground level.
- Layer 7. Natural yellow clay.

The occupation sequence

Three periods of human activity are represented by the several stratigraphic layers in Area V. Two relate to Maori occupation of Raupa and one to subsequent use of the area.

Level I. Postholes and hangi scoops are dug into the surface of Layer 6, while on the surface are piles of hangi stones (Fig. 34). In the small area exposed to give some knowledge of lower layers of Area V there were too few of either to provide any pattern. Indications are of a much used and re-used part of the Raupa settlement with numerous hangi and related shelters or fences. From one of the hangi pits charcoal was recovered, identified as predominantly tawa with some mapou and rare ramarama.

Level II. The second use of this part of the Raupa site (Fig. 35) saw the dumping or laying down of crushed shell midden, some bone, large quantities of waste stone fragments and charcoal, all in a rich black sandy soil. The crushed nature of the shell and other waste indicates that this material was shifted about before being dumped here.

Shell fragments were mostly pipi with some *Macra* sp. and cockle and other species such as green mussel and speckled whelk (*Cominella adspersa*). Mammal bones included dog pelvis fragments, metacarpals, phalanx, femur shaft and a possible scapula fragment. A single kiore tibia was identified. A much larger tibia fragment was possibly human. Rare fishbone included snapper, red gurnard and eagle ray, and possibly also blue mackerel, trevally and eel (*Anguilla* sp.).

Level III. Some time after rock flour began to come down the Ohinemuri River from the quartz crushing batteries in the Karangahake Gorge this part of the Raupa site was ploughed, the plough turning over the ground and bringing down rock flour. Five discrete lenses were visible in the north section and strips of rock flour extended from the south-west to the north-east across the excavated square to indicate the direction of ploughing.

Fishhook

An externally barbed fishhook fragment (Fig. 46), probably of an 'Oruarangi point' (Fisher 1935), was found in metre square D3 on the surface of the midden layer. The piece measures only 13 mm in length and has been charred black by fire.

Obsidian

Area V produced very little obsidian. This was partly because not all of the material was removed, although Layer 4 which provided most was entirely excavated. There was a marked concentration of material at the north end of the square (see Table 10). Clearly, however, there was little work with obsidian at this part of the site. A total of only 32 pieces weighing 133.9 g cannot compare with 4.2 kg removed from nearby Area IV. Area V material was all of characteristic green Mayor I material.

Of the small quantity only 20% was less than 1 g in weight. This may be compared with Areas I, III and IV where such very small fragments comprised 40% of the total. As these are probably waste from the manufacture of larger flakes the comparative lack of very small fragments may be interpreted as indicating a lack of obsidian

For cultural reasons, these images have been removed.
Please contact Auckland Museum for more information.

Fig. 34. Area V. Level I surface, 14 February 1987. View to west.

Fig. 35. Area V. Level II surface, 11 February 1987. View to west.

Table 10. Area V obsidian distribution, from 32 pieces of 133.9 grams.

Square	Layers 1-3		Layer 4		Layer 5	
	No.	Wt (g).	No.	Wt (g).	No.	Wt (g).
A1			1	3.4		
B1			7	24.7	1	5.3
C1			2	29.4		
D1	3	5.5	2	20.0		
E1			1	0.7		
A2						
B2						
C2	1	18.1	2	7.0	2	3.0
D2			1	3.0		
E2			1	0.4		
A3			2	2.1		
B3			2	6.1		
C3						
D3			1	1.0		
E3						
A4						
B4						
C4						
D4						
E4						
A5			1	0.5		
B5						
C5						
D5			2	3.7		
E5						
	4	23.6	25	102.0	3	8.3

working in the Area V part of the Raupa site. Of the remainder, 60% was 1-5 g, 9% 5-10 g and 9% 10-20 g. Just one piece was found of more than 20 g, a 27.0 g piece from metre square C1. On five pieces only was edge damage noted to indicate use as a tool.

Chert

Only three pieces of chert weighing a total of 15.0 g were recovered from Area V. All are waste with no sign of any use.

DISCUSSION

The Raupa settlement

Archaeological trenching and excavations in 1983, 1984 and 1987 throw considerable light on the defences and interior organisation of the Raupa settlement. Work by Phillips has shown that behind the outer of three ditches which cut the narrow neck of the Waihou River bend was a defended area of two hectares (Phillips 1986:110). Natural erosion of the site over the century and a half since abandonment suggests that this is a minimum figure. Raupa was thus, for some part of its history at least, a pa or defended settlement of very considerable size.

Behind the defensive ditches trenching and excavation has nowhere shown waste or completely unoccupied ground. Work carried out has, however, been of a salvage nature on a comparatively limited part of the site. Large parts of the formerly defended area have been destroyed both at the north end of the site and beneath and adjacent to the stopbank; or were unavailable for investigation outside the stopbank to the south-west (see Fig. 2). Thus we cannot be sure that all the defended 2 ha or more was occupied to the extent that has been shown by archaeological work carried out in what was after all, the central part of the pa.

Within that limited part of the Raupa settlement archaeology has shown a variety of purposes to which different parts of the site were put. That there was some continuity of these activities in the fully excavated Areas I, II and IV suggests both that there was a continuity of settlement from the first Maori occupation period to the last, or in any event that the basic arrangement of such living places depended upon clearly understood principles. Such principles would depend upon a mix of practicality, and of encompassing spiritual ideas and the prohibitions and directions they engendered which throughout the world govern the form and use of vernacular architecture and living spaces. At Raupa the shape of the house, the separation of cooking and dwelling spaces, the necessary open ground before the dwelling house, the proximity of food storage to cooking areas and the internal fences or stockades which direct routes through the pa all provide evidence of settlement plan. The house will be discussed separately, but first evidence of the wider settlement arrangement needs to be examined.

Because Areas III and V were not fully excavated it is only the last Maori occupation period for which we have information from all five areas excavated in 1987. In addition, of course, the 1983 and 1984 work tells us much concerning the settlement at this late stage. Trench A (see Fig. 2) which was put through the site by Simon Best, is illustrated by Phillips (1986:97). Throughout the long east-west trench and also in the short northerly extension large quantities of shell midden and concentrated charcoal lenses were revealed. Only at the extreme west end were they absent, at least as dense deposits of shell and charcoal in primary deposition. Throughout most of Phillips' 1984 Trench E (see Fig. 2), where it cuts the Raupa site, were shell midden and deposits of charcoal and charcoal rich soil. In her area '1' Phillips reported what appears to be a double line of post and stakeholes running parallel to the river bank (Phillips 1986:99; for a plan see Phillips 1985, fig. 20). In area '2' she uncovered postholes, stakeholes and firescoops dug into what might be a

housefloor (Phillips 1986:102; plan in Phillips 1985, fig. 19), with what may have been a storage pit beneath. In the 1984 area '3' (see Fig. 2) was a possible bell-shaped pit (Phillips 1986:102,104).

The work done in 1983 and 1984 shows extensive cooking activity and the dumping of midden, which in many areas, especially the length of Trench A, overlay the postholes of earlier structures. Cooking and refuse disposal was the final Maori activity here but before then the area of Trench A especially was thickly covered with wooden structures, fences or buildings, illustrated by the numbers of postholes in the section drawings (Phillips 1986:97). Thus the final occupation period at Raupa saw much of the site given over to open ground in which the limited excavation areas revealed few hangi scoops which might have been the source of the widespread midden and charcoal waste.

In the 1987 Areas I and II the evidence is the same. The final Maori occupation levels (III-IV in Area I and Level III in Area II) are marked by widespread often crushed (redeposited) shell midden and charcoal. In Area I the surface of Level III, illustrated in Fig. 11, shows clearly the nature of this surface, heavily trodden, but except for two or three isolated postholes revealing no sign of activity or use. The picture at the surface of Area II Level III was the same but without even a posthole to break the unrelieved surface. At Area I, the Level IV surface was essentially the same as Level III except that the surface has been further raised, apparently by flooding, at this comparatively lowlying edge of the site. Subsequently thin lenses of charcoal settled over parts of it. These are fragile and yet intact, to suggest that at the time this part of the Raupa site had little human traffic.

North of Trench A the 1987 excavation presented a very different picture. In Areas III and IV the late occupation period is marked by the large house and its immediate environs. This almost certainly dates from the period in the early 19th century during which Marsden visited Raupa. It is worth noting that he refers to, "... natives' houses here [which] were much larger and better built than any I had seen in New Zealand" (Elder 1932:255), so it is apparent that the Area III building was by no means the only one. Indeed, there was almost certainly at least one even larger house as it is doubtful the five Europeans listed by Marsden, as well as seamen and approximately 50 Maori, could have fitted into the Area III house for the night.

Areas III and IV were very different from I, II and V in the lack of shell midden and black charcoal soil which in the latter areas marked the last occupation period of the Raupa site. Even the cooking area at the north-west of Area III did not appear to have had repeated use; also the shell midden along the east side was mostly clean and gave every appearance of being deposited but once and not subsequently shifted about to crush the shell and make everything black with charcoal. In Area IV midden was almost entirely absent. It is clear, then, that in the final phase of occupation Areas III and IV were used very differently to other excavated parts of the site. Here was a dwelling of some importance, not to be defiled by cooking in the immediate vicinity and used for a variety of activities both social and economic, some of which have left signs and some of which may be inferred.

Foremost among activities which have left clear signs is stone working and working with stone tools in fashioning articles from wood or fibre. Ninety-two per cent of obsidian recovered in the 1987 excavations and 95% of chert came from these two areas. Also from here came two adzes, pieces of two patu muka, a pumice pot, incised stone, patu onewa blade, and fishhook and bird spear fragments. The obsidian cache in Area IV and concentration of chert and obsidian at the south-east corner of the square, also the comparatively large quantities of both stones recovered along the house east wall in Area III are all indicative of more than just random and accidental loss of these multi-purpose raw materials. It is interesting to speculate that the cache may once have been contained in a now vanished bag. The other concentrations almost certainly reflect working areas or, in the case of the house wall, perhaps storage or tidying habits as well.

The very large quantity of kokowai in Areas III and IV also has a bearing on the occupants' perception of this part of the site and the uses to which it was put. As Holdaway (1984) has pointed out, dry red ochre and ochre mixed with oil to form a paint (*kura*) was much the most commonly used colouring for a very wide variety of Maori purposes. Houses, canoes, pataka (elevated storehouses), posts, clothes and people might all be smeared or painted red on occasions. Interestingly red appears to have been used by women for body colouring more commonly than it was by men (Holdaway 1984:117-119). Particular males, including fighting men and young chiefs and some older men, also used red ochre or *kura* for body colour on occasions (Holdaway 1984:122). Painting the body seems to have ceased by about the 1840s.

Holdaway went on to explore the use of ochre or *kura* paint on artefacts. He concluded that "The element which is common to all symbolic associations of the colour red is *tapu*" (Holdaway 1984:148). The use of red paint thus had significance at a number of interrelated levels relating to Shirres' (1982:47) partial definition of *tapu* as, "being with potentiality for power." The colour red thus communicated the need to beware — to behave carefully with prescribed forms of respect towards people and towards their buildings and other possessions. Prestige, pride and politics were all involved, as was the necessity of a commonly understood stage for social behaviour upon which human actors were always mindful of the mediation of cosmology and of the spiritual world.

At the north (front) and west side of the house working and waste disposal activities clearly post-date the house occupation. It is in the adjacent Area IV that we see more clearly the open ground which probably once extended fully across the front of the house, and the use to which it was put. The hard trodden surface in the south-west corner of the square was essentially the same as that encountered within the house itself (Fig. 32). Beyond were two amorphous pits in which nesting lenses of charcoal, burnt clay and mixed fill show that fires were lit within. The pits are very different from *hangi* scoops found elsewhere in the site. Almost certainly they mark fireplaces for warming or open cooking fires depicted, for example, by Earle (Murray-Oliver 1968:117). Nearby a scatter of postholes indicates the site of a roofed building or fence which marked the edge of the open ground before the Area III house. The very large quantity of obsidian and chert flakes, and artefacts which included pieces of two different patu muka, confirm the importance of this area as a work place, in part

confirming Bank's comment that, "... the porch seems to be the place for work, and those who have not room there must set upon a stone or the ground in its neighbourhood" (Beaglehole 1962 II:18).

Fifteen to twenty metres north of Areas III and IV, Area V, like I and II, has evidence only of cooking and waste disposal. Thus the variety of necessary domestic and industrial activities at Raupa were undertaken in different places in the settlement both for obvious practical reasons and more complex principles concerning amongst other things the required stage for social interaction and a proper relationship between the sacred and the profane in Maori life.

Work at Raupa may be added to a history of pa excavations which have taken place over several decades. Many of these have been on too limited a scale to provide information on settlement plan, but there are notable exceptions. Peter Bellwood in 1968-70 excavated 400 m², or approximately 20%, of a Waikato swamp pa at Mangakaware (Bellwood 1978:15). The Mangakaware site was similar to Raupa in its swamp location and level occupation area, but not in scale as Raupa was ten times larger in area. Bellwood uncovered evidence of complex defences behind which houses and other buildings encircled an open space *ca.* 45 x 25 m. The arrangement is similar to that depicted by Angas at Te Wherowhero's pa, Kaitote, near Taupiri on the Waikato River (Angas 1846, pl. 15). A similar situation may have existed at Raupa, not enough has been excavated to be certain, or there may have been a very different arrangement with large dwelling houses scattered throughout the pa separated by other buildings and by cooking, storage and waste disposal areas. It is possible to regard this as a multiplication of the basic arrangements, perhaps made necessary by the presence of large numbers of people or several related tribal groups.

Most pa in New Zealand are topographically more complex than swamp pa of the Hauraki Plains and Waikato. Examples are Tiromoana in Hawkes Bay (Fox 1978) and the Pouerua 'Field School Pa', inland Bay of Islands (Green & Phillips 1986). Tiromoana is a ridge-end pa defended by three transverse ditches which protect a large outer enclosure and an inner strongpoint (Fox 1978:2). In the innermost citadel there was little level ground for surface buildings or open space among numerous raised-rim kumara storage pits on narrow terraces. Outside the defensive ditch which cut off this area a large house was sited strangely across the narrow ridge top. Beyond was an extensive area within the third and outer ditch which may have provided open space for formal and informal community activities.

The Field School Pa was essentially similar in basic organisation. It was close to the enormous volcanic cone pa of Pouerua which may have provided a focus for at least some important community occasions demanding space within and in front of houses. Nonetheless, as at Tiromoana there is a marked contrast between an inner strongly defended citadel, this time of confined terraces with little evidence of food storage, and an outer area of larger terraces and open ground to provide what was not least space for a formal social arena (see Green & Phillips 1986:33).

At many pa topography was a factor in the design of social and activity spaces. At Raupa, however, as at other single level defended settlements this was not the case.

Perhaps it is at pa such as these that we will learn of the fundamental requirements of settlement plan which were worked out at more difficult sites as the shape of the land allowed.

The house

In 1971-72 a rectangular Maori dwelling radiocarbon dated to the 12th century was excavated at an undefended settlement site in the Moikau valley, Wairarapa (Prickett 1979). In the analysis it was argued that identification and interpretation of this building depended upon the essential conservatism of the form and, more than that, on the persistence of social and symbolic ideals which relate to the so-called wharepuni form (Prickett 1982). Since then Newman (1989:17) and others have argued that we should not be too rigid in our identification of houses and that there was a variety of traditional house forms, as indeed archaeology has shown. Nonetheless the rectangular house with porch at the front, internal hearth and small door is a useful model for archaeologists.

The wharepuni model is essential in the interpretation of the Raupa evidence. Here the building was not complete. Clearly it was rectangular and we are able to infer its dimensions from available information, but there is no hearth apparent, nor door. It is possible that a porch is marked by the slight angle near the north end of the east side wall. It was probably not the largest house at Raupa, as I have suggested, but it is a building big enough to satisfy Marsden's comment regarding large houses. Something of the manner of its use can be inferred from a great deal of 18th and 19th century historical observation (Prickett 1982). Houses of this form provided a living space and a symbolic structure that secured people within their natural and spiritual worlds. Almost certainly this was a building which was at once a dwelling, a guest house, and a focus of activity and pride for at least part of the Raupa community.

Such a house also provided space for mundane activities such as that relating to the large numbers of chert and obsidian pieces found in Area III. Even more stone material was found outside the front of the house in Area IV, but within the building too was clear evidence of the making of sharp-edged cutting and scraping tools (the core pieces show that tool preparation took place here) and more importantly the use of these tools in fibre and perhaps wood work as well. The patu muka pieces in Area IV show that muka, or prepared flax fibre, was made here; sharp cutting knives especially of obsidian quality were crucial in the manufacture of muka and of resulting garments.

The concentration of chert and obsidian at the sides of the house has been remarked upon and the suggestion made that this reflects the storage of stone along the walls of the house or perhaps the need to keep the centre of the house swept clean of sharp flakes which might cut bare feet. The distribution may also relate to prescribed places within the house for the people who worked here with sharp flake tools. Interpretation of stone flake distribution in the Moikau house (Prickett 1979:45) depended upon historical accounts of social and sexual divisions of space within the wharepuni. At Raupa the evidence is not straightforward: chert flakes are concentrated along the right side (looking out) as at Moikau, but obsidian is abundant at both side walls and across the centre and front of the building. Only at the rear is

it uncommon. Historical evidence indicates that the right side and rear of houses were women's places and it is here therefore that one would expect to find stone flakes resulting from fibre work which was carried out by women.

Detailed measurements of the house walls have already been discussed, as has the predominance of kauri among surviving post timbers. The kauri was almost certainly obtained from foothills and ranges to the east in clear preference to kahikatea and possibly rimu which were the tall timber trees of the adjacent levees and plain. Matai and totara, other large podocarps with straight easily worked timber, were less important. Kahikatea appears not to have been used at all in the house (but was made use of elsewhere at Raupa for the massive post in Area II). The posts were not of plank form as is the case for some excavated house posts (for example at Moikau, Prickett 1979:35; and Tiromoana, Fox 1978:25), but appear to have been round or near-round in cross-section.

Other than the posts there was little information on the architecture of the Raupa house. At the rear wall a second row of posts behind the main structural line at one side of the ridge-post suggests the holding in place of wall insulation despite this feature not occurring elsewhere. Behind the rear wall is a shallow trench filled with sand presumably designed to help keep water from soaking through to the house floor.

Economy

Among the more surprising results of the 1987 excavation was the discovery of a storage pit, almost certainly for kumara (*Ipomoea batatas*), in Area II. It has been remarked how close was the bottom of this pit to the underlying watertable, thus leaving little margin for error in the preservation of a root crop for which dampness would lead quickly to total loss. It is unlikely this was the only storage pit at Raupa. Perhaps the pit-shaped fill deposit shown in Phillips' (1986:103) area '2' section makes a second, especially as it was only a few metres from the 1987 pit and apparently shared the same orientation. The evidence for a bell-shaped storage pit at Phillips' area '3' is less convincing (Phillips 1986:102,104).

In his 1820 account Marsden describes, "... some small farms ... cultivated for potatoes" (Elder 1932:256). Whether these potatoes were in fact 'sweet potatoes' (kumara) or the recently introduced European potato is unclear. It is likely by this date that northern hemisphere food plants such as potato, turnips, cabbage, maize and squash were cultivated by the people of the Hauraki Plains as elsewhere in New Zealand (see Leach 1984). The natural levees of the plains would have provided ideal conditions for gardening close to the Raupa site.

The most numerous waste material from food consumption at Raupa is shell, as is the case in almost all New Zealand sites. Everywhere the vast majority of shell was pipi, with some cockle, *Macra* common in places, and a wide range of other shell represented, not all of them necessarily food waste. The three most common shells are all obtained from beaches or soft shores, almost certainly from the Firth of Thames ca. 40 km from the pa by the Waihou River. Also in the Firth of Thames are rocky shores with green mussel, *Cookia* and other species. Other rich marine resources are available

east of Raupa on the Bay of Plenty coast, but the Firth of Thames is more easily accessible by canoe transport especially when large quantities of shellfish and other such heavy items were involved.

Fish remains were few in number and variety. The most common was snapper, again probably from the Firth of Thames. Eagle ray, obtained from shallow sea and tidal river, was identified from Areas II, III and V. Other sea fish include gurnard, john dory, blue mackerel, trevally and kahawai. Kahawai, like eagle ray might also have been obtained in the lower reaches of the Waihou River. Almost certainly caught in the river is the yellow-eyed mullet from Area II, and eel of which one possible identification was made from among Area V material.

It would be reasonable to assume that fish would have been brought into the site in very considerable quantities as a diet staple. In the midst of a very large area of swamp and waterways eel was almost certainly of importance, as would have been snapper and other fish of the Hauraki Gulf.

The only bird bone was recovered from Area I. Pigeon and kaka would have been obtainable from forest stands on the plains or from the nearby ranges. Duck and banded rail are birds of swamp and fresh waterways.

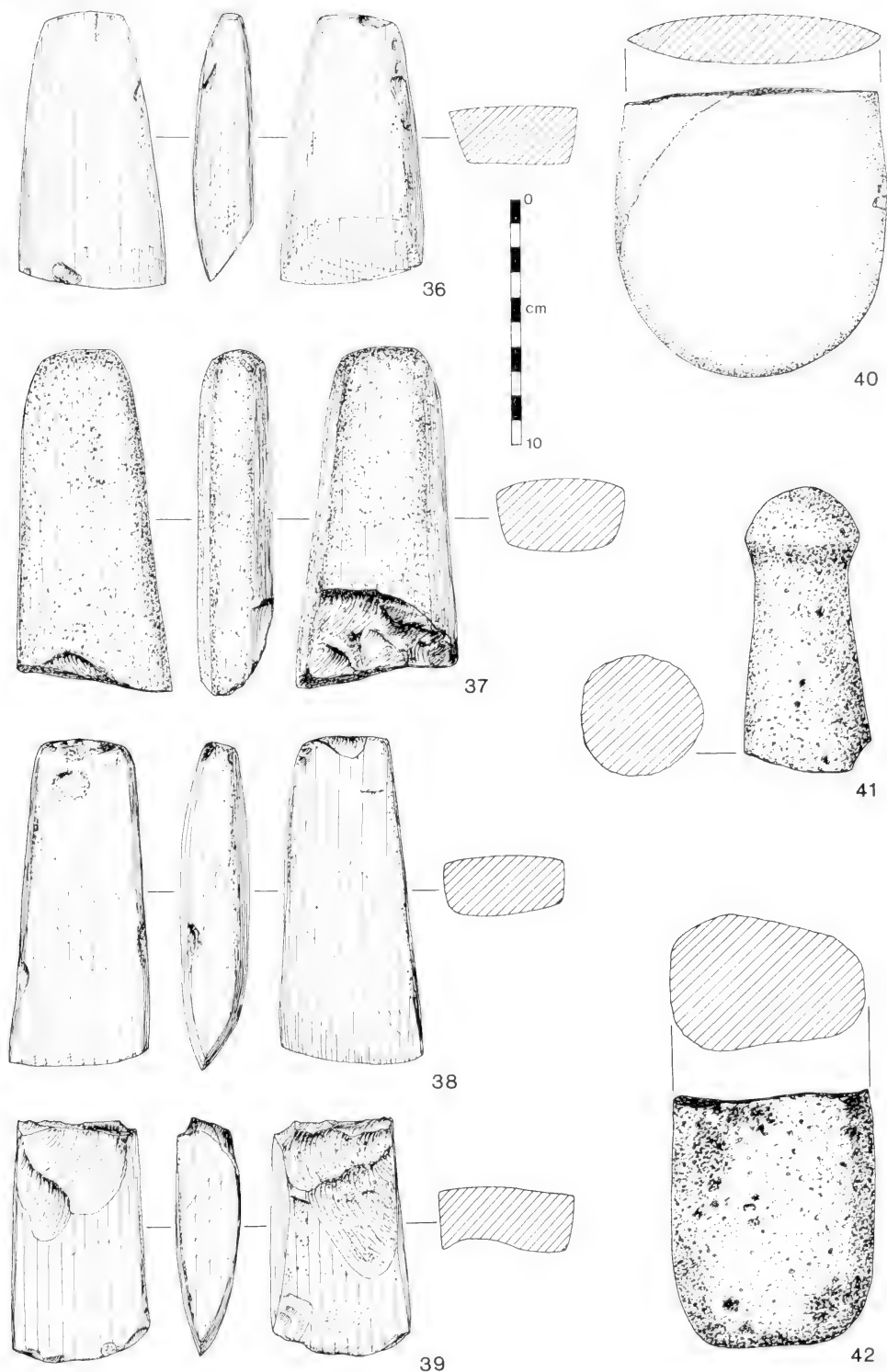
More important than fish and birds in terms of food quantity were mammals of which the most abundant remains are dog recovered from all five excavated areas. In addition to their importance as food, dogs provided essential resources for a class of prestige cloaks and for a variety of bone implements including needles and fishhooks. Other mammals represented in recovered midden remains include kiore, and sea mammal of dolphin and whale sizes. Pig bone from Areas I, II and III is a small indication of the often remarked importance of a food resource introduced in the 18th and early 19th century by European explorers and missionaries.

Fragmentary human bone was found mostly in Area III. Small quantities were identified from Area I and possibly Area V. Almost certainly this material was food waste — it was fragmentary, was in association with other midden material and clearly had been treated without respect. The burials in Area III which demonstrate much care and respect serve to emphasise the casual discard of other waste human bone.

Artefacts and stone material (Figs. 36-49)

It was a disappointment that over 200 m² of excavation at Raupa produced comparatively few artefacts. The ambition to give some archaeological context to the Oruarangi collections of which we know very little was thus not achieved. Nonetheless something was learned at Raupa of the material culture of a Hauraki Plains swamp pa at which many or all finds probably date from the 18th and early 19th centuries.

Adzes and adze fragments are all of the common rectangular, or rounded-rectangular, Duff (1956:166) Type 2B, form, the common adze of late pre-European sites, especially in the North Island. In this respect Raupa is little different from Oruarangi (see Fisher 1936; Golson 1959:55-56). Three of the four illustrated adzes (Figs. 36,37,39) are made of green greywacke, almost certainly of Waiheke Group

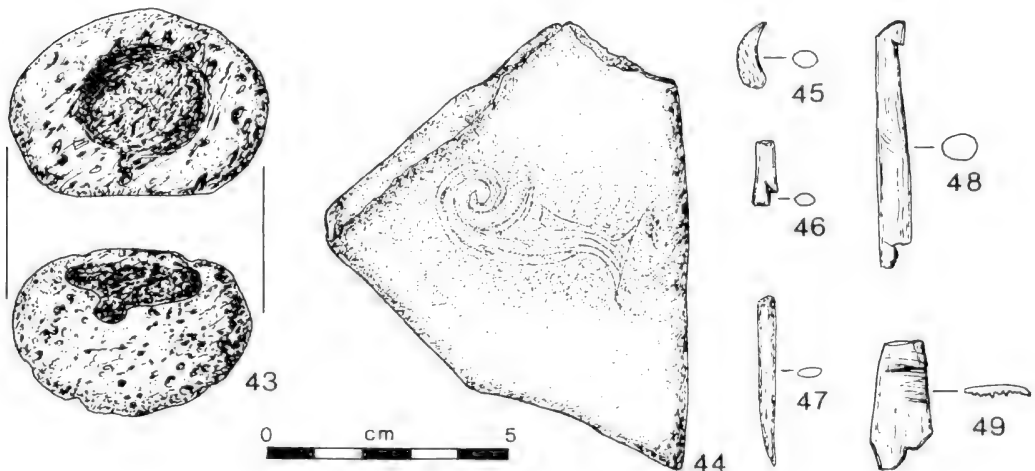


Figs 36-42. Raupa stone artefacts. 36. Adze, Area IV E1. 37. Butt end of adze, Area I E2. 38. Adze, Area I E2. 39. Blade end of adze, Area IV B3. 40. Patu onewa blade, Area III J6 and J10. 41. Patu muka handle, Area IV D5. 42. End of patu muka, Area IV C2.

material from the inner Hauraki Gulf islands (Rakino, Motutapu, Waiheke and Ponui) and the west side of the Firth of Thames (see Fig. 1). Two polished adze fragments from Areas I and IV are also of Waiheke Group greywacke. The remaining complete adze (Fig. 38) is of fine-grained pale grey basalt from the Tahanga, Coromandel Peninsula, source (see Fig. 1). At the Matatuahu site, Manukau South Head, Waiheke Group greywacke was the dominant raw material among late adzes of Duff Type 2B form (Prickett 1987:61, 63). The predominance of the same material among Raupa adzes is confirmation of the importance of this material.

Another significant item made of the same material is the patu onewa found in Area III (Fig. 40). Although highly polished surfaces present difficulties in stone identification it is likely there are many other weapons of the same material among northern North I collections. Green Waiheke Group greywacke was also identified among fire-cracked oven stones, the vast majority of which, however, almost certainly came from the nearby eastern ranges. Two patu muka pieces (Figs. 41,42) are, like the adzes, similar to Oruarangi examples, as is the apparently unused pumice pot (Fig. 43).

Almost all of 11.17 kg of obsidian recovered during the 1987 excavation came originally from Mayor I in the nearby Bay of Plenty (see Fig. 1). Small quantities were identified as having come from Waihi and even less from Whangamata. Clear grey obsidian may have originated at Taupo or Great Barrier I. Mayor I is the source of most obsidian found in New Zealand archaeological sites so it was not surprising to find it so dominant in Raupa less than 60 km away by land and water. All the 5.56 kg of chert almost certainly came from the nearby Coromandel and Kaimai Ranges.



Figs 43-49. Small pumice, stone and bone artefacts. 43. Pumice pot, Area IV C3. 44. Incised stone, Area IV D2. 45. Fishhook point, Area III J7. 46. Fishhook fragment, Area V D3. 47. Bone needle, Area I A5. 48. Bird spear fragment, Area III I7. 49. Tattoo chisel fragment, Area I D3.

Bone artefacts were very familiar. Fishhook (Figs. 45,46) bird spear (Fig. 48) and tattoo chisel (Fig. 49) fragments and an unfinished needle (Fig. 47) are identical to items among the much larger Oruarangi collection. As at Oruarangi, dog jaws were probably used for needles and 'Oruarangi' hook points. Fishing, birding, fibre working and tattooing are represented by the handful of bone artefacts. Tattooing is also likely to be represented by the incised stone (Fig. 44) from Area IV which may give a direct insight into the purpose to which tattoo chisels were put.

Towards a history of Raupa

At the opening of the discussion section is an outline of the settlement arrangement for the only occupation period which was fully uncovered throughout the five excavated areas. This was the last major occupation of Raupa and certainly relates to the early 19th century, perhaps restricted to the years immediately about 1820 for which we have Marsden's account. A reconstruction illustration of Raupa at the time of Marsden's visit is given in Fig. 50. this late occupation period is represented by Area I Levels III and IV, Area II Level III, Area III the house floor and environs, Area IV Level II and Area V Level II. Other occupation levels and evidence add to knowledge of the history of Raupa.

In Areas I, II, IV and V are earlier occupation levels. At Area V the occupation level immediately preceding the final Maori occupation is marked by hangi scoops and oven stones (Fig. 34), probably closely related in time and purpose to the final deposit of crushed shell midden and cooking waste. The same situation was evident in Area II where dark soil and shell midden, much of it crushed to show repeated mixing and shifting, was spread over the Level II cooking ovens.

At Area I two occupation levels preceded the final use of this part of the site for waste disposal. Levels I and II are both marked by postholes (Figs. 7,9). Level I was not fully excavated but the mostly small post and stakeholes suggest light roofed structures were first built here close to the bank above the Waihou River. Later (Level II) there was at least one very strongly built structure here, possibly roofed but more likely a lookout or fighting platform as I have suggested. If the big close-set posts are related to a stockade then they indicate renewed defences or a strengthening of existing defensive works here. The Level III dumping of midden in Area I indicates that this part of Raupa was still used at this late stage although no longer by defences or roofed structures. By Level IV there was little active use of this area for any purpose.

A similar sequence is apparent in Area II where the earliest occupation is marked by postholes (Figs. 14,15) and the later by cooking (Level II) and waste disposal (Level III). In Areas I and II there is a considerable change in the use to which these parts of the site were put from early to late levels. It is as if the built part of the site later diminished in size or was concentrated elsewhere within the 2 ha of ground behind the northern defensive lines. The later occupation of Areas I and II show this part of Raupa to be given over almost entirely to cooking and waste disposal on essentially open ground.

For cultural reasons, this image has been removed.
Please contact Auckland Museum for more information.

Fig. 50. Reconstruction of Raupa depicted in the late afternoon of 17 June 1820 when the Rev. Samuel Marsden and his party were welcomed to the settlement by the chief, probably Te Hikamate of Ngati Tamatera. Depiction of the visitors and host group is based upon Marsden's description. The size and orientation of the large house depend upon the 1987 archaeological evidence, as do the cooking area and storage pit at the right rear and the presence of pigs in the foreground. Through the gap in the stockade can be seen Mt Te Aroha.

At Area IV there was continuity between Levels I and II. Both have postholes to show that structures stood here. In Level II are firepits which are not associated with midden remains and thus may have been for warmth and social purposes connected to the nearby Area III house.

The Area III house itself was burnt down, after which part of the former house floor was used for cooking. Waste material, including human bone was discarded and trodden into the compact ground surface. It may be that the destruction of the house and the subsequent activities there were connected. Rihitoto (1893:111) in his land court evidence regarding the Nga Puhi attack on Raupa in the early 1820s indicated that the Nga Puhi were defeated. Perhaps there is evidence here to the contrary. Unless there was a subsequent attack or violent incident at Raupa about which we know nothing, increasingly unlikely in the years or decades after 1820, the Nga Puhi attack on Raupa may have been successful. Perhaps they burned down one or all of the great houses which so impressed Marsden and then feasted on their defeated enemies in the ruins of the pa. We cannot be certain of this but such a history would provide an economical use of the archaeological evidence.

Some time after Raupa was abandoned as a living place it was made use of as a burial ground or urupa. Such a sequence of events is known to have been common in many parts of New Zealand in the 19th century and in all probability occurred earlier as well. By this means important genealogical and spiritual connections would be maintained with ancestors and their living places.

The two Area III burials display different burial customs. In the case of Burial 1 the intact body was laid on its left side with knees drawn up to the chest (compare with Oppenheim 1973, opp.p.48). The other was a secondary burial of partly disarticulated bones. Both were in shallow pits less than 600 mm deep. Both burials were in all probability pre-Christian in their treatment of the dead; thus they date from the period between the abandonment of the site and the conversion of Hauraki people to Christianity in the middle years of the 19th century. Nor, it may be argued, were these the only burials in Area III. Near the rear wall of the house was a soft depression (Fig. 23) which was not investigated in 1987 for lack of time. Experience in the 1988 excavation showed that there was almost certainly a burial here, one of a number that occupied this part of Raupa and which represented an important use of the site after it was abandoned as a settlement in the third or fourth decade of the 19th century.

Acknowledgements. My first acknowledgement is to the Ngati Tamatera whose history we were uncovering and who were so supportive of our work. Special thanks are also due to the people of Te Pai o Hauraki marae where the large excavation team was accommodated throughout the 1987 and 1988 seasons. In particular I would like to acknowledge and thank Huhurere Tukukino, Dick Rakena, Mate Royal and Winnie Hutchinson.

The Raupa excavations would not have been achieved without a large and enthusiastic team of over sixty volunteer archaeologists, by whom I hope I will be forgiven for not listing all names. There are some people, however, who deserve special mention: Pat Stodart helped bring together the equipment and provided essential organisational help throughout the 1987 season. Area supervisors included Garry Law, Nancy Tayles, Tony Walton, Margaret Prebble, Moira White, Reg Nichol, and Anne Leahy who was on site for the whole six week season; other volunteers who gave six weeks work were Jolanda Cupido and Brendan Jones.

Initial sorting and analysis of material was carried out by volunteers Janet Romanes, Alan Graham and Ngaire Chaplin. Specialist analysis was undertaken by Rod Wallace, Anthropology Department, University of Auckland (wood and charcoal identification); Ian Smith, Anthropology Department, University of Otago (mammal bone); Kath Prickett, Auckland (stone material); Reg Nichol, Auckland (fish bone); Phil Moore, Waihi (obsidian); Liz Hudson, Auckland (human bone) and Rick McGovern-Wilson, Anthropology Department, University of Otago (bird bone). The Chemistry Division, Department of Scientific and Industrial Research, Mt Albert, Auckland, was responsible for testing for dried blood on the incised stone found in Area IV. I am grateful to Caroline Phillips who freely shared with me her knowledge of the site. Caroline is also responsible for the maps, plans and section drawings in this report. Joan Lawrence drew the artefacts. Artist Chris Gaskin prepared the reconstruction illustration (Fig. 50). Mary Best has been an excellent and long-suffering typist.

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THE MOSSES OF MINERS COVE, GREAT BARRIER ISLAND, NORTHERN NEW ZEALAND

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Abstract. Eighty-four species of mosses from 32 families are recorded from the Miners Cove area of northern Great Barrier Island, Hauraki Gulf, New Zealand. *Fissidens hyophilus* Mitt., a moss known from Queensland, Australia, is recorded new to New Zealand. Two other species with tropical affinities, which have seldom been recorded from New Zealand, were found in the area: *Syrrhopodon armatus* Mitt. of the Calymperaceae and *Thuidium cymbifolium* (Dozy & Molk.) Dozy & Molk. of the Thuidiaceae. The modifying effects of goats and pigs on the moss communities are noted.

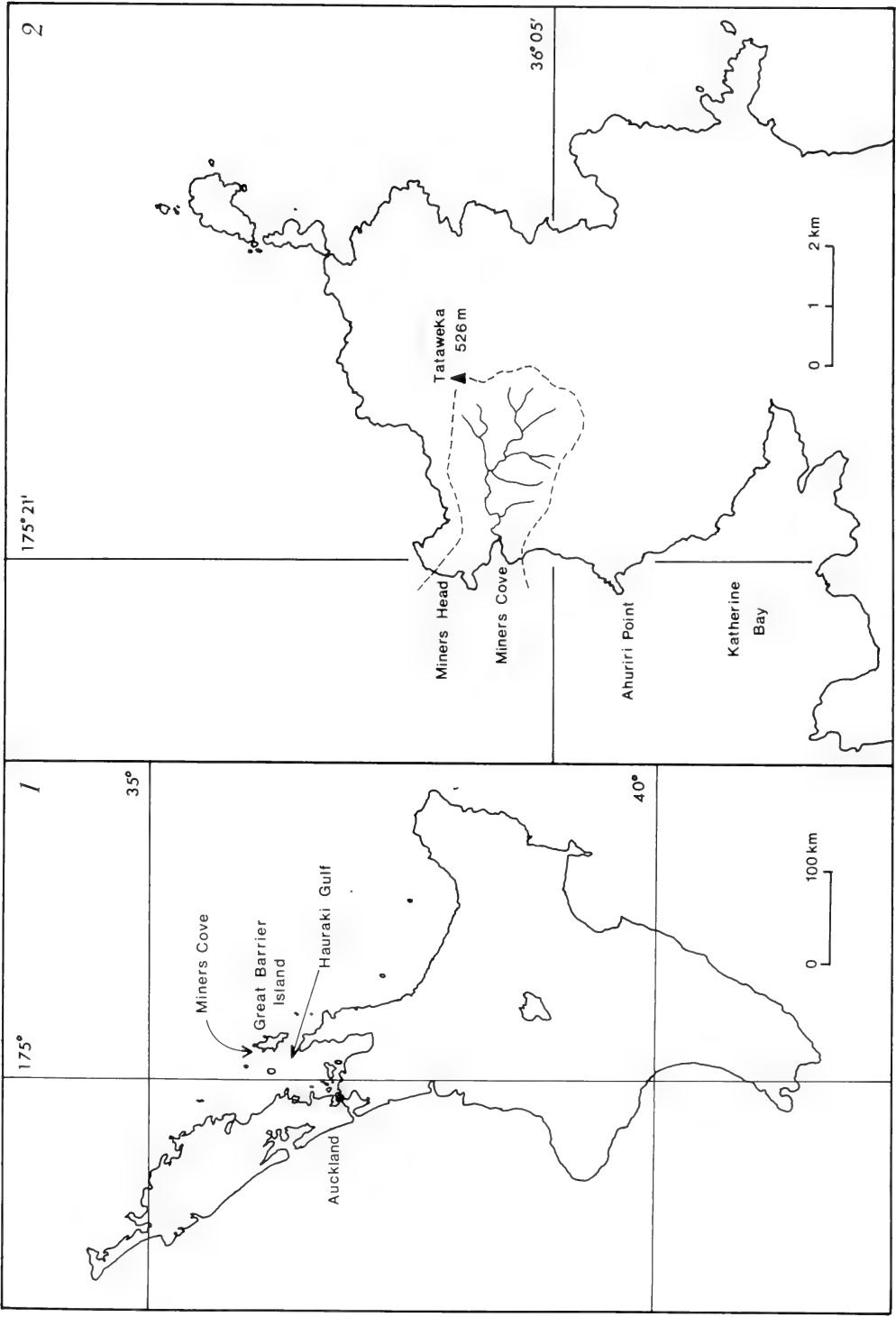
Miners Cove, in the far north-west of Great Barrier Island, lies at latitude 36° 05'S longitude 170° 21'E at the outer edge of the Hauraki Gulf, northern New Zealand (Figs. 1,2). This paper is based on observations and collections made during a visit of the Offshore Islands Research Group to Miners Cove from 30 December 1988 to 7 January 1989. A survey for mosses was carried out in the area from the coast to the peak of Tataweka, at 526 m the highest point in northern Great Barrier, with the main emphasis being in the lower reaches of the Miners Cove catchment. Although seven days were spent in the field, field work was hampered by bad weather.

Vascular plant vegetation

Near the coast, grassland and tea-tree scrub cover the slopes and valley floor, but most of the catchment supports a modified coastal forest, dominated by puriri (*Vitex lucens* Kirk), kohekohe (*Dysoxylum spectabile* (Forst. f.) Hook. f.) and taraire (*Beilschmiedia tarairi* (A. Cunn.) Kirk). Extensive damage by goats, culled two years prior to the visit, and by pigs, has resulted in a very open understorey to the forest. A detailed account of the vascular flora of the area is in preparation by E.K. Cameron and A.E. Wright (pers. comm. June 1990).

Previous bryological studies

Bryophytes have been collected sporadically on Great Barrier I for many years, and numerous specimens are held in herbaria, both in New Zealand and overseas. These are the basis of a number of published records of mosses from the island, as in the monographs of the family Hypnodendraceae (Touw 1971) and the genus *Macromitrium* (Vitt 1983), and in more general accounts of the northern offshore



Figs. 1,2. Location of study area. 1. Location of Miners Cove, Great Barrier I, and the northern tip of Great Barrier I showing study area (circumscribed by dotted line). 2. Northern tip of Great Barrier I showing study area (circumscribed by dotted line).

islands (Beever 1986a), and of the New Zealand moss flora as a whole (Sainsbury 1955). The type specimen of *Stereodon maculosus* Dix., now regarded by some as a form of *Camptochaete pulvinata* (Hook. f. & Wils.) Jaeg., was collected by Hutton and Kirk last century, probably on Great Barrier I, although the specimen is merely labelled 'N.Z.' (Sainsbury 1955). There are however to my knowledge no published accounts of the moss flora of the island as a whole, nor of any of its regions.

Major features of the moss communities

In areas of grassland near the coast both *Hypnum cupressiforme* and *Thuidium furfursum* were common among the herbaceous plants, with *Bryum campylothecium* and *Macromitrium brevicaulis* occurring on exposed rock.

The main stream draining the valley is sufficiently broad in its lower reaches to allow a considerable canopy gap over the stream, and thus light-requiring mosses such as *Tridontium tasmanicum*, *Fissidens vittatus*, and *Ptychomitrium australe* were found on stream-side rocks, with *Brachythecium plumosum* on large boulders in the stream. *Fissidens asplenioides* and *Hypopterygium rotulatum* were common on soil on the stream banks, as were *Thuidium furfursum* and *Camptochaete pulvinata* on silt-covered rock at the stream margins. *Thuidium cymbifolium* was recorded at two sites beside the main stream of the catchment, one on silt over rock at the stream margin, and the other on sloping soil above the stream. Luxurious growth of *Achrophyllum dentatum* occurred in seepages along stream banks, with *Homalia falcifolia* forming extensive sheets in drier sites. *Leptostomum macrocarpum* was seen occasionally as an epiphyte, but was more common on rock outcrops above the stream, in areas of high light.

Few mosses were found on the forest floor. *Fissidens oblongifolius* var. *capitatus* and *Echinodium umbrosum* occurred on sloping soil, with *Distichophyllum crispulum* in the wetter sites. Epiphytes were scarce in the forest, the most common being *Macromitrium gracile*. Other epiphytes recorded several times included *M. ligulare*, *Thuidium sparsum*, *Orthorrhynchium elegans*, *Haplohymenium pseudotriste*, and *Dicnemon calycinum*, with *Ctenidium pubescens* occasional on tree bases, as well as on soil. *Calomnion complanatum* was very common on trunks of the tree-fern *Cyathea dealbata*, while *Syrrhopodon armatus* was occasional in the same habitat.

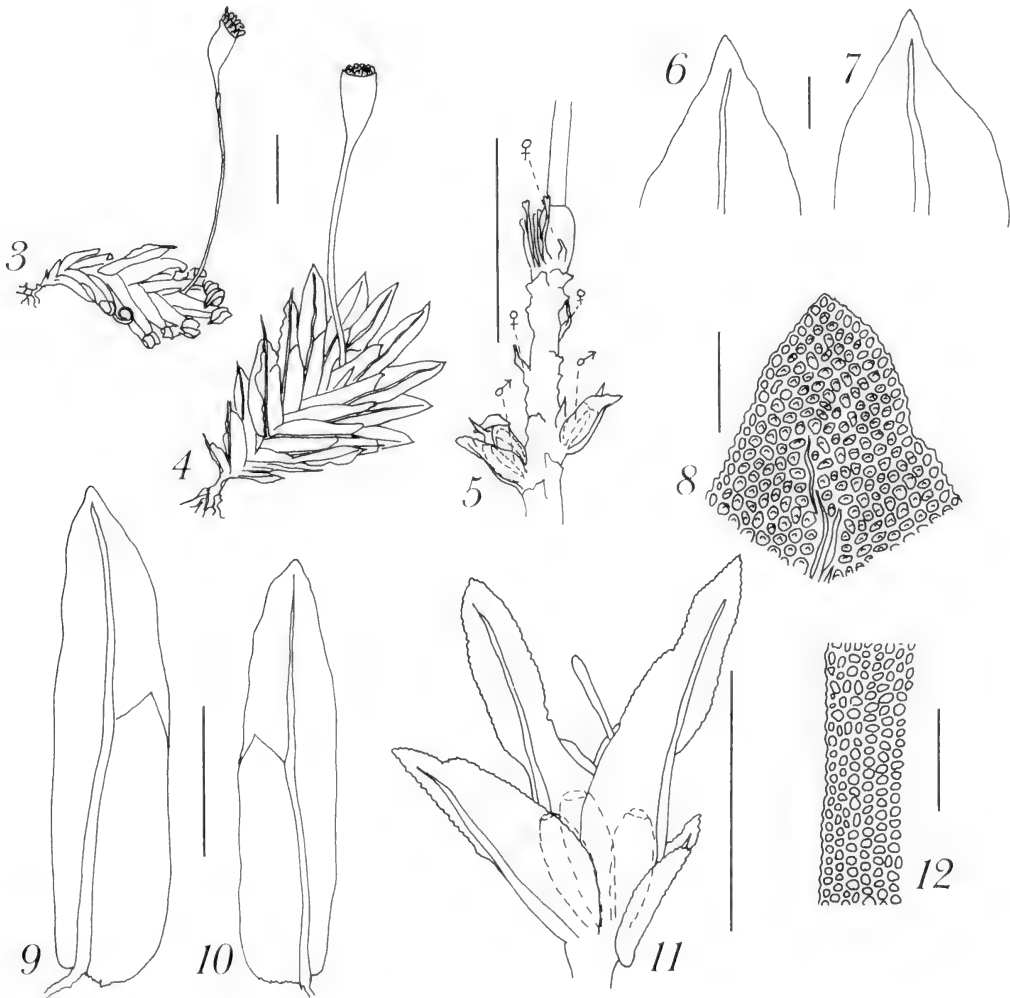
The open understorey, due to the activities of goats and pigs, has no doubt contributed to the paucity of ground-dwelling and epiphytic mosses in the forest. Habitats associated with the streams have probably also been modified as a result of animal activity, due to increased water run-off and decreased soil stability. Twice during the study period the stream banks were scoured by silt-laden floodwaters, when the main stream rose approximately 1 m above its normal level.

Floristics

In all, 84 species from 32 families were recorded. Most are widespread species, common in open coastal communities or forest throughout New Zealand. Some, such as *Macromitrium brevicaulis*, *Haplohymenium pseudotriste* and *Fissidens*

oblongifolius var. *capitatus*, have a northern distribution within the country. Of particular interest is the recording of three mosses of tropical affinity which have only recently been recognised in New Zealand, namely *Fissidens hyophilus*, *Syrrophodon armatus*, and *Thuidium cymbifolium*.

Fissidens hyophilus Mitt. (Figs. 3-12), a species previously known from Queensland, Australia, is here recorded new to New Zealand. It has been confused with the morphologically similar *F. oblongifolius* Hook. f. & Wils. var. *capitatus* Wils.



Figs. 3-12. *Fissidens hyophilus* Mitt. 3. Plant, dry. 4. Plant, moist. 5. Upper part of fertile stem with leaves removed to show base of seta, archegonia, and perigonal buds with antheridia. 6, 7. Leaf apices. 8. Cells of leaf apex. 9, 10. Leaves. 11. Perigonal bud with antheridia. 12. Cells at margin of vaginant lamina. Figs. 3, 4, 6-10, 12. Poor Knights Is (AK 195501). Figs. 5, 11. Poor Knights Is (AK 195500). Scale Bars. Figs. 3, 4, 5. 1mm. Figs. 6, 7. 0.1mm. Figs. 8, 12. 50 μ m. Figs. 9, 10, 11. 0.5 mm.

in Hook. f., but is distinctive in the field in having the tips of the leaves rolled up away from the substrate when the plants are dry (Fig. 3). In addition the capsules are narrow and more or less straight (Figs. 3,4), rather than broad and curved as they are in *F. oblongifolius* var. *capitatus*. Both species are autoicous, with male gametangia found in axillary buds on the stem (Fig. 5), but the leaves of these buds are less well developed in *F. hyophilus* (Figs. 5,11). Figure 13 shows the known distribution of *F. hyophilus* in New Zealand, and is based on the author's field work and also on specimens found when the holdings of *F. oblongifolius* in the herbaria of the Auckland Institute and Museum (AK), the Botany Department, University of Auckland (AKU), the Botany Institute, DSIR Land Resources (CHR), and the National Museum of New Zealand (WELT) were critically examined. The New Zealand distribution reflects the tropical affinities of the moss, with all records coming from low elevation sites on the North Auckland peninsula and its offshore islands, plus one specimen from the Kermadec Islands. Of the 11 specimens for which substrate data were available, 6 specimens were from rock, most commonly from the vertical side or sloping underside of outcrops or large boulders, with rock types including greywacke and rhyolitic breccia; 4 were epiphytic, on nikau palm (*Rhopalostylis sapida* Wendl. & Drude), tawapou (*Planchonella costata* (Endl.) Pierre ex H.J. Lam) or *Coprosma areolata* Cheesem.; and one was from exposed roots. All 11 were from shaded sites. Several of these collections have already been cited in publications, namely J.E. Beever 31-77 and 31-95 from Whangaruru North Head (Beever 1985); J.E. Beever 28-85 (misprinted as 29-85), 29-86 and 29-89 from the Poor Knights Is (Beever 1986b), all as *Fissidens oblongifolius*; and J.E. Beever 57-69 from Hukatere Scenic Reserve (Beever 1990), as *Fissidens* sp. (epiphytic).

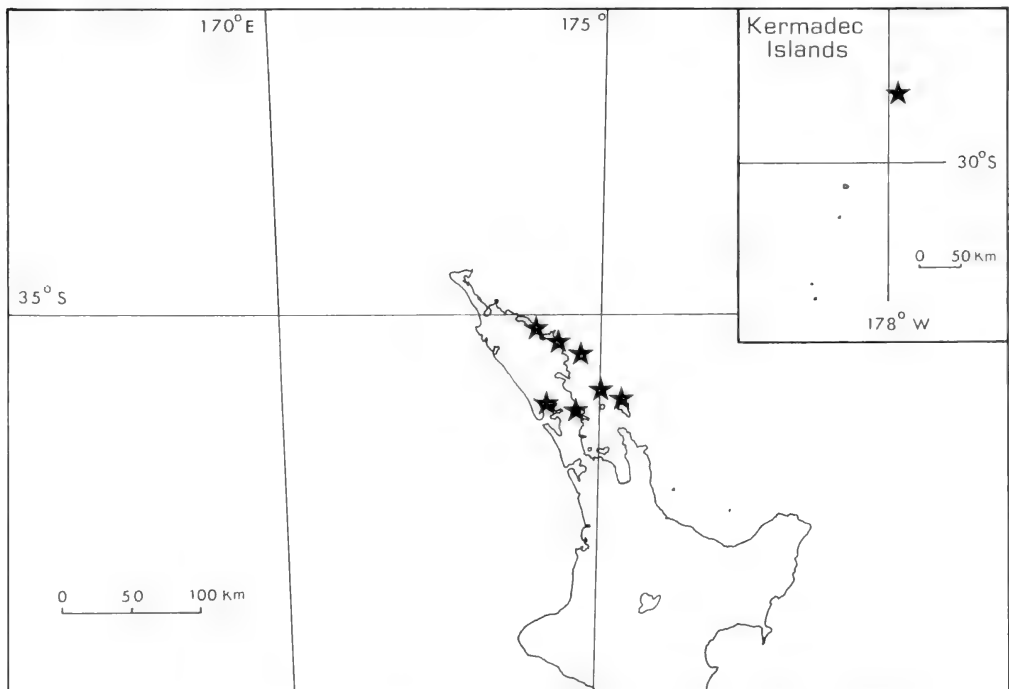


Fig. 13. Known distribution of *Fissidens hyophilus* Mitt. in New Zealand.

Syrrhopodon armatus Mitt., a widespread tropical species, was first recorded in New Zealand by Reese & Bartlett (1982), as *S. fimbriatulus* C. Muell., at Hot Water Beach on the Coromandel Peninsula. It has since been recorded in two other northern coastal sites, at Whangaruru North Head (Beever 1985) and on the Poor Knights Is (Beever 1986b). Although inconspicuous in the field, this moss is distinctive under the microscope, with large spines on the nerve and lower leaf margins, quite unlike any other New Zealand moss. On Great Barrier it was found on trunks of *Cyathea dealbata* in rather open coastal forest, along stream banks in the middle reaches of the Miners Cove catchment.

Thuidium cymbifolium is a tropical Indopacific species. New Zealand material has recently been recognised by Touw & Falter-van den Haak (1989), who located 5 New Zealand specimens, three of them with detailed locality data, in the course of examining herbarium material of *Thuidium* for a revision of the Australasian members of that genus. The species has in the past been confused with *Thuidium laeviusculum* (Mitt.) Jaeg., which it resembles in its regular and compact bipinnate to tripinnate branching pattern, and in the robust primary stems densely clothed with paraphyllia. At the microscopic level *T. cymbifolium* is easily distinguished from *T. laeviusculum* as it has a single papilla on each leaf lamina cell, while *T. laeviusculum* has multipapillose lamina cells. In addition, on the leaves of the ultimate branches, the cells on the back of the nerve towards the nerve apex are smooth, or bear large single teeth, while those of *T. laeviusculum* are multipapillose. *T. cymbifolium* can be distinguished from the other two species of *Thuidium* recorded at Miners Cove, namely *T. sparsum* and *T. furfurosum*, by its regular, compact, and more highly divided, branching pattern. Critical examination of holdings of *T. laeviusculum* in AK and AKU (not examined by Touw & Falter-van den Haak), and further field work, have brought to light more material of *T. cymbifolium*, and some 8 localities are now known for this moss in New Zealand, all of them north of latitude 36° 35'S.

The 'maculosa' form of *Camptochaete pulvinata*, for which Great Barrier I is believed to be the type locality, was common in the Miners Cove area. It occurred both on rock, especially on large boulders in small tributary streams, and on tree bases and large exposed roots, e.g. of puriri. Both compact dendroid forms, and long, pinnately branched runners were observed. Sometimes regarded as a separate species from *C. pulvinata*, there has been considerable uncertainty about the correct taxonomic position of this moss, and collections were made of fruiting material for future studies.

SPECIES LIST

This list includes all species of mosses that were found in the Miners Cove area, and the accession numbers of voucher specimens lodged in Auckland Museum.

Bartramiaceae

Philonotis tenuis (Tayl.) Reichdt. AK 181014

Brachytheciaceae

Brachythecium plumosum (Hedw.) B.S.G. AK 189059

Rhynchostegium tenuifolium (Hedw.) Reichdt. AK 189049

Bryaceae

- Bryum billardierei* Schwaegr. var. *platyloma* Mohamed AK 189057
Bryum campylothecium Tayl. AK 189052
Bryum dichotomum Hedw. AK 189055
Bryum erythrocarpoides C. Muell. & Hampe AK 189087
Leptostomum macrocarpum (Hedw.) Pyl. AK 189098
Pohlia wahlenbergii (Web. & Mohr) Andr. AK 189042

Calomniaceae

- Calomnion complanatum* (Hook. f. & Wils.) Lindb. AK 189109

Calymperaceae

- Syrrhopodon armatus* Mitt. AK 189068

Cyrtopodaceae

- Cyrtopus setosus* (Hedw.) Hook. f. AK 189099

Dicnemonaceae

- Dicnemon calycinum* (Hook.) Schwaegr. AK 189093

Dicranaceae

- Campylopus clavatus* (R. Br.) Wils. AK 189037
Campylopus introflexus (Hedw.) Brid. AK 189054
Campylopus pyriformis (Schultz) Brid. AK 189056
Dicranella clathrata (Hook. f. & Wils.) Jaeg. AK 189045
Dicranoloma fasciatum (Hedw.) Par. AK 189101
Dicranoloma menziesii (Hook. f. & Wils.) Par. AK 189108, AK 181019
Holomitrium perichaetiale (Hook.) Brid. AK 181018, AK 181017
Leucobryum candidum (P. Beauv.) Wils. AK 189092

Ditrichaceae

- Ditrichum difficile* (Duby) Fleisch. AK 189090

Enchinodiaceae

- Echinodium umbrosum* (Mitt.) Jaeg. AK 189102

Fissidentaceae

- Fissidens asplenioides* Hedw. AK 189040
Fissidens humilis Dix. & Watts var. *angustifolius* Dix. AK 189060
Fissidens hyophilus Mitt. AK 194663
Fissidens leptocladus C. Muell. & Rodw. AK 189032
Fissidens oblongifolius Hook. f. & Wils. var. *capitatus* Wils. in Hook. f. AK 194795
Fissidens pungens C. Muell. & Hampe AK 189076
Fissidens rigidulus Hook. f. & Wils. AK 189088
Fissidens tenellus Hook. f. & Wils. AK 189083
Fissidens vittatus Hook. f. & Wils. AK 189085

Funariaceae

- Funaria hygrometrica* Hedw. AK 189086

Grimmiaceae

- Schistidium apocarpum* (Hedw.) B.S.G. AK 189064

Hookeriaceae

- Achrophyllum dentatum* (Hook. f. & Wils.) Vitt & Crosby AK 189043
Achrophyllum quadrifarium (Sm.) Vitt & Crosby AK 189077
Distichophyllum crispulum (Hook. f. & Wils.) Mitt. AK 189074

Hypnaceae

- Ctenidium pubescens* (Hook. f. & Wils.) Broth. AK 189050
Hypnum chrysogaster C. Muell. AK 189048
Hypnum cupressiforme Hedw. AK 189034

Hypnodendraceae

- Hypnodendron arcuatum* (Hedw.) Lindb. AK 189094

Hypopterygiaceae

- Cyathophorum bulbosum* (Hedw.) C. Muell. AK 189105
Hypopterygium commutatum C. Muell. AK 189078
Hypopterygium filiculaeforme (Hedw.) Brid. AK 189079
Hypopterygium rotulatum (Hedw.) Brid. AK 189041
Lopidium concinnum (Hook.) Hook. f. & Wils. AK 189080

Lembophyllaceae

- Camptochaete arbuscula* (Sm.) Reichdt. AK 189103
Camptochaete gracilis (Hook. f. & Wils.) Par. AK 189097
Camptochaete pulvinata (Hook. f. & Wils.) Jaeg. AK 189106
Camptochaete ramulosa (Mitt.) Jaeg. AK 189075

Metesoriaceae

- Papillaria crocea* (Hampe) Jaeg. AK 189089
Weymouthia cochlearifolia (Schwaegr.) Dix. AK 181021
Weymouthia mollis (Hedw.) Broth. AK 181023, AK 181024

Neckeraceae

- Homalia falcifolia* (Hook. f. & Wils.) Hook. f. & Wils. AK 189046
Homalia punctata (Hook. f. & Wils.) Wijk & Marg. AK 189073
Porotrichum oblongifolium (Hook. f. & Wils.) Broth. AK 189067
Thamnobryum pandum (Hook. f. & Wils.) Stone & Scott AK 189044

Orthotrichaceae

- Macromitrium brevicaule* (Besch.) Broth. AK 189053
Macromitrium gracile (Hook.) Schwaegr. AK 181020
Macromitrium ligulare Mitt. AK 189081
Macromitrium longipes (Hook.) Schwaegr. AK 181016
Zygodon intermedius B.S.G. AK 189082

Phyllogoniaceae

- Orthorrhynchium elegans* (Hook. f. & Wils.) Reichdt. AK 189058

Plagiotheciaceae

- Catagonium nitens* (Brid.) Card. AK 189047

Polytrichaceae	
<i>Pogonatum subulatum</i> (Brid.) Brid.	AK 189091
<i>Polytrichadelphus magellanicus</i> (Hedw.) Mitt.	AK 189095
Pottiaceae	
<i>Hymenostomum patulum</i> (Knight) Dix.	AK 188972
<i>Tortula pagorum</i> (Milde) De Not.	AK 189033
? <i>Trichostomum brachydontium</i> Bruch*	AK 189038, AK 189051, AK 189110
<i>Tridontium tasmanicum</i> Hook. f.	AK 189063
<i>Triquetrella papillata</i> (Hook. f. & Wils.) Broth.	AK 189036
Pterobryaceae	
<i>Trachyloma diversinerve</i> Hampe	AK 189100
Ptychomitriaceae	
<i>Ptychomitrium australe</i> (Hampe) Jaeg.	AK 181013
Ptychomniaceae	
<i>Cladomnion ericoides</i> (Hook.) Hook. f. & Wils.	AK 181022
<i>Ptychomnion aciculare</i> (Brid.) Mitt.	AK 181015
Racopilaceae	
<i>Racopilum convolutaceum</i> (C. Muell.) Reichdt.	AK 181026
<i>Racopilum robustum</i> Hook. f. & Wils.	AK 189065
Rhizogoniaceae	
<i>Hymenodon pilifer</i> Hook. f. & Wils.	AK 189066
<i>Pyrrhobryum bifarium</i> (Hook.) Manuel	AK 189084
Sematophyllaceae	
<i>Sematophyllum amoenum</i> (Hedw.) Mitt.	AK 189039
<i>Sematophyllum contiguum</i> (Mitt.) Mitt.	AK 189062
Thuidiaceae	
<i>Haplohymenium pseudotriste</i> (C. Muell.) Broth.	AK 189107
<i>Thuidium cymbifolium</i> (Dozy & Molk.) Dozy & Molk.	AK 189061, AK 189096
<i>Thuidium furfurosum</i> (Hook. f. & Wils.) Reichdt.	AK 189035
<i>Thuidium sparsum</i> (Hook.f. & Wils.) Jaeg.	AK 189031, AK 189104

* While *Trichostomum brachydontium* Bruch was not positively recorded at Miners Cove, 3 specimens have been tentatively identified as such. The plants were collected from soil and weathered rock in lightly shaded sites, and have plane leaf margins and more than 6 cells in the axillary hairs, but lack mature capsules.

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RECORDS OF WILDLIFE FROM TONGA, ESPECIALLY VAVA'U

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Abstract. Records are presented of reptiles, birds and mammals seen (and reptiles collected) in September and October 1989 on six islands of the Vava'u group (Vava'u, Pangaimotu, 'Utungake, Okoa, Koloa and Kapa), Kingdom of Tonga. A few records from Tongatapu and Ha'apai are included. The Dandy Skink (*Emoia trossula*) is reported from Vava'u for the first time. A map shows localities where this lizard and the endemic Tongan Whistler (*Pachycephala jacquinoti*) were seen in the Vava'u group. Green-backed Herons (*Butorides striatus*) are reported from Tonga for the first time, and the second record of the White-faced Heron (*Ardea novaehollandiae*) in Tonga is given.

The current distribution of reptiles, birds and mammals in the Tongan archipelago has been reported in recent papers by Dhondt (1976), Gill (1987, 1988) and Rinke (1986a, 1986b, 1987). In this paper I present further distributional records based on:

- (1) My observations of wildlife, and collections of reptiles, in September-October 1989. Where no observer or date are given the observations were by me at this time. I spent nine nights on Tongatapu, with day-trips to Atatā and Pangaimotu Is (Tongatapu group). I spent 15 nights at Neiafu (Vava'u I) from where I travelled that island extensively by motor vehicle and on foot, and made day excursions within the Vava'u group to Pangaimotu, 'Utungake, Okoa and Koloa Is (which are connected to Vava'u I by causeways) and Kapa I (which is not). The records of reptiles and land birds on the six Vava'u group islands are summarised in Table 1.
- (2) Some incidental records from Tongatapu, Ha'apai and Vava'u; my own, where no observer is given, or supplied by others, and so acknowledged.

Where weights and snout-vent lengths (SVL) of lizards are given in the main systematic list, I took these in September-October 1989 from freshly killed specimens. The reptiles were collected for Auckland Museum, and the registration numbers (prefix H) are given. In Table 2, however, the measurements were taken after preservation. Specimens of *Cryptoblepharus* are referred to *eximius* rather than *poecilopleurus* on advice from G.R. Zug.

In the lists that follow, Vava'u (as opposed to "Vava'u group"), Pangaimotu, 'Utungake, Okoa, Koloa, Kapa, 'Oto and Nuku are individual islands of the Vava'u archipelago. "Vava'u group" is used for some or all of these islands taken together.

Table 1. Summary of reptiles and land birds recorded on six Vava'u islands, September-October 1989.

	VAV*	PANG	UTU	OKOA	KOL	KAPA
REPTILES						
<i>Gehyra oceanica</i>	+		+			+
<i>Lepidodactylus lugubris</i>	+					
<i>Cyrtodactylus pelagicus</i>	+					
<i>Cryptoblepharus eximius</i>	+		+			
<i>Lipinia noctua</i>	o		+			
<i>Emoia cyanura</i>	+					+
<i>E. pheonura</i>	+					+
<i>E. trossula</i>	+				o	o
LAND BIRDS						
Banded Rail	o				o	
Purple Swampphen	o					
Crimson-crowned Fruit-dove	o	o	o			o
Pacific Pigeon	o	o	o		o	o
Barn Owl	o					
White-rumped Swiftlet	o	o	o	o	o	o
Collared Kingfisher	o	o	o	o	o	o
Polynesian Triller	o	o	o	o	o	o
Tongan Whistler	o		o			
Polynesian Starling	o	o	o	o	o	o
Wattled Honeyeater	o					

*VAV — Vava'u, PANG — Pangaimotu, UTU — 'Utungake, KOL — Koloa, + — specimen collected, o — sighting only.

Note that there is a Pangaimotu I in each of the Vava'u and Tongatapu groups. Lake Ngofe, the smaller of the two lakes at the south-west tip of Vava'u I, and a good habitat for rails, was so overgrown with tall reeds that it appeared from the edge to have no standing water.

REPTILES

Oceanic Gecko *Gehyra oceanica*

Vava'u: House gecko, Neiafu (H1290). Under bark of rotting trees in forest, Mt. Talau (H1292-7), and edge of plantation near Holonga (H1307). *'Utungake*: Under bark in forest (H1301). *Kapa*: In decaying timber structure (H1315). SVL 31-75 mm, weight 0.8-9.5 g (n = 10).

Mournful Gecko *Lepidodactylus lugubris*

Vava'u: House gecko, Neiafu (H1286-8), or under bark of rotting trees at forest edge, Mt. Talau (H1298-9). SVL 23-48 mm, weight 0.2-2.6 g (n = 5).

Pelagic Gecko *Cyrtodactylus pelagicus*

Vava'u: Near Holonga, in rotten tree stump at edge of plantation (H1306, SVL 48 mm, weight 2.7 g).

Snake-eyed Skink *Cryptoblepharus eximius*

Vava'u: From town pavement, Neiafu (H1289), and pier at Tu'anuku village (H1316). *'Utungake*: Nga'unoho, in litter above strand line of sandy beach (H1302). SVL 36-37 mm, weight 0.6-0.9 g (n = 3).

Moth Skink *Lipinia noctua*

Atatā I, off Tongatapu: Under stacks of dead weeds in plantation (H1283-5, SVL 42-47 mm, weight 1.6-1.9 g). *Vava'u*: Seen. *'Utungake*: Under sheet of cardboard at roadside (H1300, SVL 40 mm, weight 1.2 g).

Emoia cyanura species group

These lizards were widespread and common in the *Vava'u* group in both forests and plantations. Following the description by Ineich (1987) of *Emoia pheonura*, a cryptic sibling species sympatric with *E. cyanura*, each individual must be examined closely to determine to which of these species it belongs. Of the seven specimens I collected in the *Vava'u* group, three were *pheonura*. These, and all three specimens from *Atatā I*, lacked fusion of scales along the mid-dorsal line. Of the four specimens of *cyanura* from the *Vava'u* group, two had extensive fusion of mid-dorsal scales, but H1309 had only two pairs of fused scales. H1291 showed no scale fusion on the mid-dorsal line but had other characters of *cyanura* (post-mental groove, dark thighs and no frontoparietal spot).

Blue-tailed Skink *Emoia cyanura*

Vava'u: H1291, H1308-9. *Kapa*: H1313.

Cryptic Skink *Emoia pheonura*

Atatā I, off Tongatapu: In plantation litter (H1280-2). *Vava'u*: Tefisi (H1310-1). *Kapa*: H1314.

Dandy Skink *Emoia trossula*

This species, one of several long called "*E. samoensis*", was described from Fiji and Rotuma by Brown & Gibbons (1986) and reported from Rarotonga, Cook Islands group, by Crombie & Steadman (1986). Gibbons & Brown (1988) listed it from 'Eua (Tongatapu group), without further details, which is the first published report of this species from Tonga. I caught three adults of this species (H1304, H1312, H1317), and a juvenile (H1305), on *Vava'u I*. I saw them at many localities on *Vava'u*, *Koloa* and *Kapa Is* (Fig. 1).

In addition to the four specimens from *Vava'u*, I have examined nine specimens of this species from 'Eua collected by D.R. Rinke, October 1983 to May 1984 (ZFMK 41101-7 and 41585-6, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, West Germany). Table 2 summarises the size and scale-counts of all 13 specimens. These data agree entirely with the diagnostic features of the Fijian populations (Brown & Gibbons 1986), which are: snout-vent length up to 103.0 mm, mid-body scale-rows 32-40, and lamellae under fourth toe 42-54. In colour and pattern the Tongan specimens fit Brown & Gibbons' description. They resemble the Fijian specimen that Brown & Gibbons illustrated in fig. 2 except that in Tongan adults the dark dorsolateral blotches and the bright longitudinal dashes on the back and sides are much less developed. These features are more pronounced on some of the Tongan juveniles.

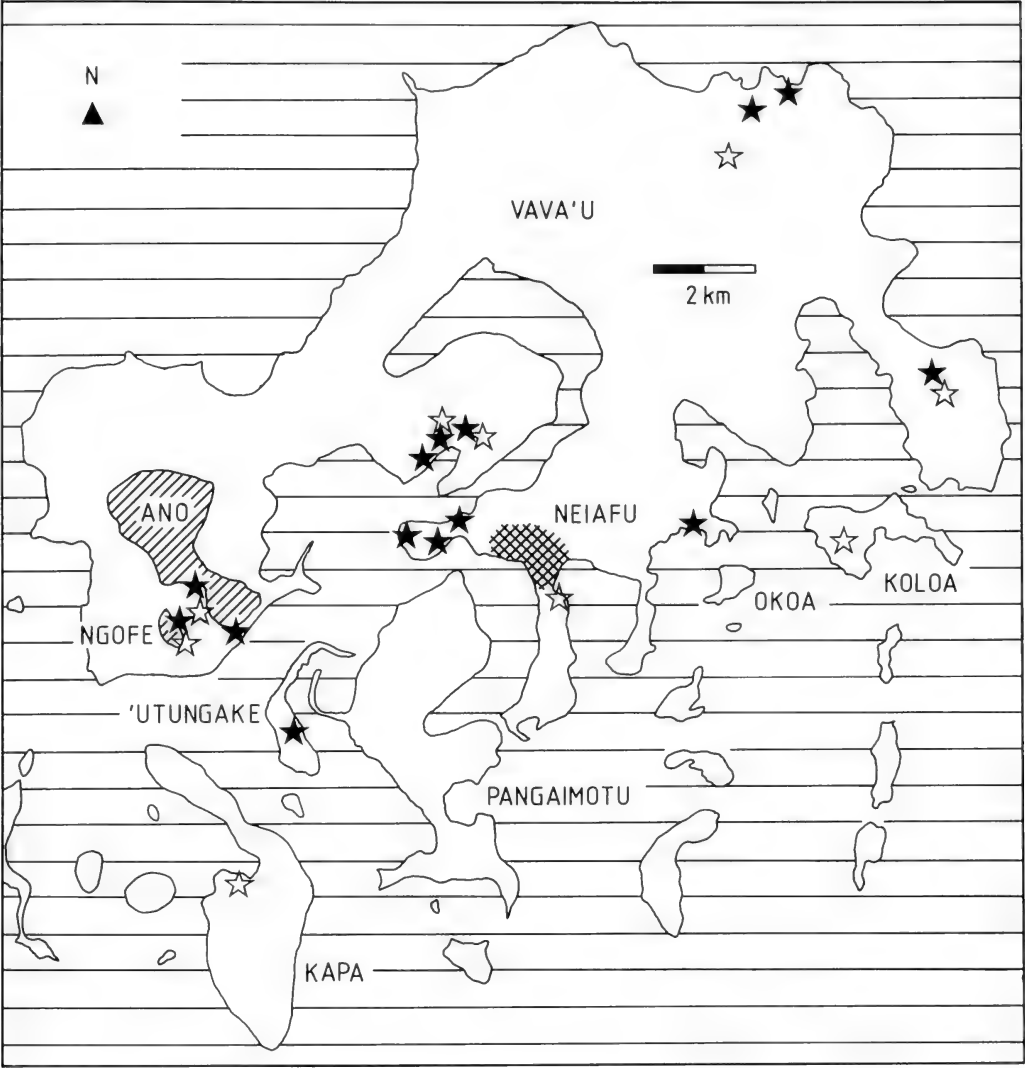


Fig. 1. Northeastern part of the Vava'u group showing the main town (Neiafu), Lakes Ano and Ngofe, and the names of the islands visited. Closed stars show where Tongan Whistlers were seen or heard; open stars where Dandy Skinks were seen or caught.

Table 2. Size (mm) and scale-counts of *Emoia trossula* from Vava'u I and 'Eua.

Location	Age	n	SVL	Mid-body scale rows	4th toe lamellae
Vava'u	ad.	3	90.0-100.0	33-35	48-52
Vava'u	juv.	1	48.6	34	46-48
'Eua	ad.	2	98.3-103.6	32-33	45-46
'Eua	juv.	7	36.4-64.8	34	46-52
All specimens		13	36.4-103.6	32-35	45-52

On Vava'u, Koloa and Kapa Is, I saw *E. trossula* in plantations and associated scrub. Often I disturbed them at the roadside and they ran up the nearest tree trunk.

“Cook’s Tortoise” (Tu’i Malila)

Tongatapu: The tortoise currently in the Royal Palace grounds (Gill 1988) arrived in Tonga on 16 September 1966 (*Tonga Chronicle*, 23/9/1966). It was a gift to the Kingdom from the National Geographic Society which obtained it from Madagascar intending it to be a mate for the tortoise that died on 18 May 1966. It is presumably *Testudo radiata*, and was named “Tu’i Malila II” by King Taufa’ahau Tupou IV.

BIRDS

White-tailed Tropicbird (Tavake) *Phaethon lepturus*

Vava'u: Three at coast near Toulā. *Kapa*: One off northern tip.

Brown Booby (Ngutulei) *Sula leucogaster*

Tongatapu: One between Atatā I and Tongatapu. One feeding just off Pangaimotu Island.

Great Frigatebird (Helekosi) *Fregata minor*

Tongatapu: All black male over Nuku'alofa, February 1989 (E.F. Fabian, pers. comm.). Group of eight over Atatā I. *Vava'u*: One at cliffs north of Holonga.

Lesser Frigatebird (Helekosi) *Fregata ariel*

Tongatapu: Two over plantations near Keleti Beach. *Vava'u*: One near Neiafu. One at cliffs north of Holonga.

White-faced Heron *Ardea novaehollandiae*

Tongatapu: One on mudflats near Sopa west of Nuku'alofa on 14 March 1990 (D.T. Fabian, pers. comm.).

Reef Heron (Motuku) *Egretta sacra*

Vava'u group: Common around coast. Altogether, two white-phase and 15 grey-phase birds were seen.

Green-backed Heron *Butorides striatus*

Tongatapu: Two on mudflats near Sopa west of Nuku'alofa on 14 March 1990 (D.T. Fabian, pers. comm.).

Banded Rail (Veka) *Rallus philippensis*

Vava'u: One at edge of Lake Ngofe; one in scrubby plantation near Keitahi Beach. One at Neiafu in March 1990 (D.T. Fabian, pers. comm.). *Koloa*: One in plantation.

Purple Swampphen (Kala'e) *Porphyrio porphyrio*

Vava'u: One near Makave; 15 at edge of Lake Ngofe.

Lesser Golden Plover (Kiu) *Pluvialis fulva*

Vava'u group: On mown grass beside Lupepau'u Airport runway, on grazed land at edge of Lake Ngofe, and on village greens (Vava'u I); otherwise common on mudflats everywhere.

Wandering Tattler (Kiu) *Tringa incana*

Vava'u group: Common in ones and twos around the coast.

Bristle-thighed Curlew *Numenius tahitiensis*

Tongatapu: Several on mudflats near Sopu west of Nuku'alofa on 14 March 1990 (D.T. Fabian, pers. comm.). *Vava'u*: One on mudflats at causeway near Toula; seen at length in good light but not very closely; no buffiness of plumage was noted so it may have been a Whimbrel *N. phaeopus*, though this is unlikely.

Bar-tailed Godwit *Limosa lapponica*

Tongatapu: Several on mudflats near Sopu on 14 March 1990 (D.T. Fabian, pers. comm.).

Turnstone *Arenaria interpres*

Tongatapu: Several on mudflats near Sopu on 14 March 1990, all coming into breeding plumage (D.T. Fabian, pers. comm.). *Vava'u*: Four near causeway to Koloa I. *Pangaimotu*: Five on mudflats near causeway to Vava'u I and one near causeway to 'Utungake I.

Crested Tern *Sterna bergii*

Vava'u group: Common around the coast. Also seen at shore of Lake Ano.

Black-naped Tern *Sterna sumatrana*

Vava'u group: Common around the coast singly, in pairs, or in groups of up to 20.

Bridled Tern *Sterna anaethetus*

Vava'u group: A few at 'Oto I, west of Kapa, on 13 March 1990 (D.T. Fabian, pers. comm.). Dark above; larger than Black-naped Terns but smaller than Sooty Terns (*Sterna fuscata*); white on head appeared to extend behind eye. One sitting at the entrance to a cave was beside a small, grey, fluffy chick.

Brown Noddy (Ngongo) *Anous stolidus*

Tongatapu: Present along north coast near Nuku'alofa on 8 March 1990 (D.T. Fabian, pers. comm.).

Note: Dark noddies (species not determined) were very abundant in the inshore waters of the Vava'u group, sometimes in feeding flocks of several hundred.

Black Noddy (Ngongo) *Anous minutus*

Tongatapu: More common than *A. stolidus* along north coast near Nuku'alofa on 8 March 1990 (D.T. Fabian, pers. comm.). *Vava'u group*: Present at Nuku I west of Kapa on 13 March 1990 (D.T. Fabian, pers. comm.).

White Tern ('Ekiaki) *Gygis alba*

Vava'u: Five near Makave. Six at cliffs north of Holonga. Several flying over plantations along coast road between Leimatu'a and Tefisi. *Kapa*: Six over plantation.

Crimson-crowned Fruit-dove (Kulukulu) *Ptilinopus porphyraceus*

Note: All fruit-doves seen closely in the Vava'u group were this species. *Vava'u*: Common in village and countryside. *Pangaimotu*, 'Utungake, *Kapa*: Present.

Pacific Pigeon (Lupe) *Ducula pacifica*

Vava'u: Common in or near forest or flying between forest patches. *Pangaimotu*, 'Utungake, *Koloa*, *Kapa*: Present.

Blue-crowned Lorikeet (Henga) *Vini australis*

Tongatapu: On 20 September at Lapaha village I had clear but distant views of two small birds with blunt heads that flew quickly across open sky. They had direct flight (no dipping) and rapid wing-beats.

Barn Owl (Lulu) *Tyto alba*

Vava'u: One seen at edge of Neiafu after dark.

White-rumped Swiftlet (Pekepeka) *Collocalia spodiopygia*

Vava'u: Very common. They forage at dusk long after other diurnal birds have roosted. *Pangaimotu*, 'Utungake, *Okoa*, *Koloa*, *Kapa*: Common.

Collared Kingfisher (Sikotā) *Halcyon chloris*

Vava'u, *Pangaimotu*, 'Utungake, *Okoa*, *Koloa*, *Kapa*: Common.

Polynesian Triller (Sikiviu) *Lalage maculosa*

Vava'u: Fairly common. *Pangaimotu*, 'Utungake, *Okoa*, *Koloa*, *Kapa*: Present.

Tongan Whistler (Hengehenga) *Pachycephala jacquinoti*

Vava'u group: Quite common in suitable forested habitat. Fig. 1 shows localities where I saw this species. The immature has much rufous on the back and head. A female fed an immature on 22 September while the male called nearby.

Polynesian Starling (Misi) *Aplonis tabuensis*

Vava'u: Very common. *Pangaimotu*, 'Utungake, *Okoa*, *Koloa*, *Kapa*: Common.

Wattled Honeyeater (Fuleheu) *Foulehaio carunculata*

Vava'u: Seen at Neiafu, on Mt. Talau, at Tu'anevivale, and in flowering "flame trees" at edge of Lake Ngofe.

MAMMALS

Flying Fox (Peka) *Pteropus tonganus*

Vava'u: Seen at edge of Neiafu (few flying), western edge of Mt. Talau (many flying), beach at foot of cliffs north-east of Holonga (many roosting) and peninsula near Makave (many flying). *Ha'apai group*: About 60 seen at edge of swamp at centre of Foa I; more than 100 seen at roost on Lofanga I (July 1988).

House Mouse *Mus musculus*

Tongatapu: Auckland Museum M513, 514, coll. D.R. Rinke 1990.

Norway Rat *Rattus norvegicus*

Tongatapu: A large male seen foraging by day along a stone embankment near Queen Salote wharf, Nuku'alofa.

DISCUSSION

Having now caught and examined *Emoia trossula* I have no doubt that the large skinks I observed closely (Gill 1988) on Foa, Ha'apai group, were this species. The large skinks I saw less clearly on Tongatapu (Gill 1988) and 'Eua (Gill 1987) were very probably this species. The discovery that *E. trossula* is widespread in the main Tongan island groups gives this species a broad east-west distribution between Fiji and Rarotonga. However, it is not clear whether this is a natural distribution. Any or all of the reptiles not endemic to Tonga — the whole herpetofauna excepting *Lepidodactylus euaensis* and the enigmatic *Tachygia microlepis* — could have been transported there accidentally or deliberately by Polynesians, who first colonised Tonga just over 3,000 years ago (Davidson 1979). Crombie & Steadman (1986) discussed this problem in relation to Cook Is lizards.

D.T. Fabian's sighting of Green-backed Herons is the first record of this species from Tonga. His record of White-faced Heron is the second Tongan record of that species, which was seen at the same locality in July 1988 (Gill 1988). He was able to compare the White-faced Heron with a nearby grey-phase Reef Heron. The Green-backed Herons were seen closely enough to notice fine streaking on the breast and barring on the flanks. He knows this species well from South Africa (where he lives) and Mauritius, and did not know they were not on the Tongan list until after his sighting. Green-backed Herons are resident in the Fiji and Society Is, and rare visitors to western Micronesia and the Hawaiian group (Pratt *et al.* 1987).

Blue-crowned Lorikeets are thought to be extinct in the Tongatapu group (Rinke 1986b). Those that I saw could have been pet birds that had escaped. It was pleasing to find Tongan Whistlers widespread and well-established in the Vava'u group, as reported by Rinke (1986b). Their presence on 'Utungake seems to be a new record.

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RECORDS OF REPTILES FROM TONGA

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** BREHM FUND SOUTH SEAS EXPEDITION, NUKU'ALOFA, TONGA

Abstract. Records of reptiles from Niuafu'ou, Niuatoputapu, the Vava'u group, Late, 'Eua and 'Ata, Kingdom of Tonga, are presented, based on 167 voucher specimens collected between 1969 and 1990. *Emoia murphyi* is reported from Niuafu'ou, Niuatoputapu, and Vava'u. *E. pheonura*, the recently described sibling species to *E. cyanura*, is reported from Niuafu'ou, Niuatoputapu, Vava'u, Ha'apai, Tongatapu, 'Eua and 'Ata based on the above vouchers and re-identification of specimens in the Auckland Museum collection. The iguana *Brachylophus fasciatus* is reported from Vava'u and Tongatapu.

Tonga has a small reptile fauna comprising an iguana and several species of geckos, skinks and marine reptiles (sea-snakes and turtles). One gecko (*Lepidodactylus euaensis*), and a skink (*Tachygia microlepis*) that is known only from the two type specimens collected last century, are endemic. The other species are more widely distributed.

Recent records of the distribution of reptiles in the Tongan group have been given by Gill (1987, 1988, 1990) and Rinke (1986). In this paper we present further records based on the following museum specimens:

- (1) Two iguanas collected in Vava'u by E.W. Dawson in 1969 and now in the National Museum of New Zealand, Wellington (NMNZ).
- (2) Specimens collected on Niuatoputapu by W.P. Rogers in 1971 and now in NMNZ.
- (3) Reptiles collected on 'Eua and Niuafu'ou in 1983 and 1984 by D.R. Rinke and now in the Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, West Germany (ZFMK).
- (4) A specimen of *Emoia murphyi* collected on Okoa I (Vava'u group) in September 1989 by B.J. Gill and now in the Auckland Institute and Museum, New Zealand (AIM).
- (5) Specimens of *Lepidodactylus euaensis* collected on 'Eua in September 1989 by D.R. Rinke and now in AIM.
- (6) Specimens collected on Niuafu'ou in February 1990, on Late in March 1990, and on 'Ata in April 1990 by D.R. Rinke and now in AIM.

Field notes by D.R. Rinke and some sight records by us both are also reported. In the list that follows, the date of collection given is the key to which of the above collecting efforts is involved. Specimens of *Cryptoblepharus* are referred to *eximius* rather than *poecilopleurus* on advice from G.R. Zug. All specimens held at AIM and listed as *Emoia cyanura* in Gill (1987, 1988) have been re-examined to check for specimens of the sibling species *E. pheonura*, described by Ineich (1987).

SYSTEMATIC LIST

Banded Iguana *Brachylophus fasciatus*

Vava'u group: Ha'akio, Vava'u Island — male (NMNZ P160), female (NMNZ P161), coll. 12 Sep. 1969.

Tongatapu: Single live iguanas have been caught near Vaini (June 1989) and at Veitongo (May 1990), and seen by D.R. Rinke.

Oceanic Gecko *Gehyra oceanica*

Niuafo'ou: ZFMK 41628-31, coll. 1984.

Niuaatoputapu: Falehau — NMNZ P234-8, coll. 1971.

'*Eua*: Funga Fonua (170 m asl) — ZFMK 42047, coll. 1984; 'Ohonua — ZFMK 41114-5, coll. 1983; Hango — ZFMK 41108, 42050, coll. 1984; 'Ufilei — ZFMK 41109-13, coll. 1983.

Late: AIM H1345, coll. 1990.

Mournful Gecko *Lepidodactylus lugubris*

Niuafo'ou: ZFMK 41632-4, coll. 1984. AIM H1343, coll. 1990.

Niuaatoputapu: Falehau — NMNZ P222-33, coll. 1971.

'*Eua*: 'Ohonua — ZFMK 40769-80, coll. 1984; Hango — ZFMK 42051-5, coll. 1984.

'Eua Gecko *Lepidodactylus euaensis*

'*Eua*: Funga Fonua (170 m asl) — ZFMK 42046, 42048-9, coll. 1984; Mo'unga Te'e Moa (c. 200 m asl) — AIM H1318-20, coll. 1989.

Pelagic Gecko *Cyrtodactylus pelagicus*

'*Eua*: 'Ohonua — ZFMK 40764, coll. 1984.

Snake-eyed Skink *Cryptoblepharus eximius*

Niuafo'ou: ZFMK 41625, coll. 1984. AIM H1336, coll. 1990.

Late: AIM H1346-8, coll. 1990.

'*Eua*: 'Ohonua — ZFMK 40762-3, coll. 1984; 'Ufilei — ZFMK 41603-11, coll. 1984.

'*Ata*: AIM H1351-3, coll. 1990.

Moth Skink *Lipinia noctua*

Niuafo'ou: ZFMK 41618-24, coll. 1984. AIM H1337, coll. 1990.

Niuaatoputapu: Falehau — NMNZ P219, coll. 1971.

'*Eua*: 'Ohonua — ZFMK 40748, 42061-3, coll. 1984.

Blue-tailed Skink *Emoia cyanura*

Niuafo'ou: ZFMK 41615, 41617, coll. 1984. AIM H1339-42, 1344, coll. 1990.

Niuaatoputapu: Falehau — NMNZ P217, coll. 1971.

Late: AIM H1349-50, coll. 1990.

'*Eua*: 'Ohonua — ZFMK 40749-61, coll. 1984; 'Ufilei — ZFMK 41587-93, 41595-602, coll. 1984.

'*Ata*: AIM H1354, coll. 1990.

Cryptic Skink *Emoia pheonura*

Niuafo'ou: ZFMK 41612-4, 41616, coll. 1984. AIM H1338, coll. 1990.

Niuatoputapu: Falehau — NMNZ P218, coll. 1971.

'*Eua*: 'Ufilei — ZFMK 41594, coll. 1984.

'*Ata*: AIM H1355-8, coll. 1990.

Dandy Skink *Emoia trossula*

Tongatapu: Has been seen occasionally by D.R. Rinke.

'*Eua*: 'Ohonua — ZFMK 41102, coll. 1983; Hango — ZFMK 41103-7, coll. 1984;

'Ufilei — ZFMK 41101, coll. 1983, ZFMK 41585-6, coll. 1984.

Pacific Black Skink *Emoia nigra*

Niuafo'ou: ZFMK 41626, coll. 1984. AIM H1327-31, coll. 1990.

Niuatoputapu: Hahake — NMNZ P221, coll. 1971.

Murphy's Skink *Emoia murphyi*

Niuafo'ou: ZFMK 41627 (juv.), coll. 1984. AIM H1332-5, coll. 1990.

Niuatoputapu: Falehau — NMNZ P220, coll. 1971.

Vava'u group: Okoa I — AIM H1303, coll. 1989. A small heavily spotted *Emoia*, probably of this species, was seen by B.J. Gill in September 1989 in a clearing at the summit of Mt. Talau, Vava'u I.

Table I summarises the distribution of lizards in the Tongan archipelago based on this paper and the records of Gill (1987, 1988, 1990). In addition, we note that an unpublished report by the late J.R.H. Gibbons ("Recent sightings of the elusive *Tachygia microlepis* of Tonga?", November 1985, 6 pages) indicates that he recorded the geckos *Hemidactylus garnotii* and *Hemiphyllodactylus typus* on both Tongatapu and 'Eua. We have not recorded these species in Tonga.

NOTES ON *EMOIA MURPHYI*

In the sample of six adults of *Emoia murphyi* — all those listed above except ZFMK 41627 — the snout-vent lengths were 55-71 mm, the rows of scales at mid-body numbered 27-29 (mode 28) and the number of lamellae under the fourth toe was 64-75. This agrees with the meristics of 14 *E. murphyi* from "Samoa and Tonga islands" given by Brown & Gibbons (1986) as 26-32 scale rows and 59-82 lamellae. Our specimens match closely in coloration four specimens labelled as *E. murphyi* from the Smithsonian Institution (USNM 82951-4) which have 27 or 28 scale rows and 64-71 lamellae. (These USNM specimens were collected by H.C. Kellers in October 1930 from "Niaufou Island" which we take to be a misspelling of "Niuafo'ou".)

Burt (1930) described *Emoia murphyi* from one specimen (thought to be immature) collected on Savai'i, Western Samoa. It was 73 mm from snout to vent, with 30 rows of scales at mid-body and 84 fourth toe lamellae. We can find no further

Table 1. Distribution of terrestrial reptiles on islands or island groups of the Tongan archipelago, based on the records in this paper and in Gill (1987, 1988, 1990).

	Nf*	Nt	V	L	H	T	E	A
<i>Brachylophus fasciatus</i>			+			o		
<i>Gehyra oceanica</i>	+	+	+	+	+	o	+	
<i>G. mutilata</i>					+	+		
<i>Lepidodactylus lugubris</i>	+	+	+		+	+	+	
<i>L. euaensis</i>							+	
<i>Cyrtodactylus pelagicus</i>			+		+		+	
<i>Cryptoblepharus eximius</i>	+		+	+	+	+	+	+
<i>Lipinia noctua</i>	+	+	+			+	+	
<i>Emoia cyanura</i>	+	+	+	+	+	+	+	+
<i>E. pheonura</i>	+	+	+		+	+	+	+
<i>E. trossula</i>			+		o	o	+	
<i>E. nigra</i>	+	+						
<i>E. murphyi</i>	+	+	+					
Number of species recorded	8	7	10	3	8	9	9	3

* Nf — Niufo'ou, Nt — Niuatoputapu, V — Vava'u, L — Late, H — Ha'apai, T — Tongatapu, E — 'Eua, A — 'Ata, + — voucher specimen (seen by B.J. Gill), o — sighting only (by D.R. Rinke and/or B.J. Gill).

published information about this species or its distribution, but clearly it extends from Samoa to the northern Tongan islands of Niufo'ou, Niuatoputapu and Vava'u.

These lizards have heavily speckled, predominantly grey, dorsal surfaces with no longitudinal stripes. The undersurfaces in life are bright lime green, which fades to blue or yellow in preservative. It is an arboreal species of plantations and the forest edge.

NOTES ON THE *EMOIA CYANURA* SPECIES GROUP

Ineich (1987) examined a large sample of "*Emoia cyanura*" from French Polynesia and distinguished two forms on the basis of colour and scalation, one of which he described as a new syntopic sibling species, *E. pheonura*.

One of us (B.J. Gill) has examined 51 Tongan specimens of the *cyanura* species group held at AIM. Of the specimens listed in Gill (1987, 1988) as *E. cyanura*, the following prove to be *E. pheonura*: H1001, H1003-4, H1006-9, H1012, H1178, H1180-1, H1186-8 and H1190. The rest are *E. cyanura* in the restricted sense.

Twenty-six of the 51 specimens at AIM can be separated as *pheonura* by the absence of fusion of scales on the mid-dorsal line. These also tend to have white thighs, a frontoparietal spot and a pale, brown tail. Twenty-four specimens (*cyanura*) have fused mid-dorsal scales (often only a few), dark thighs and a tendency for there to be no frontoparietal spot and a dark blue tail. H1185, with dark thighs and no dorsal scale fusion, could be either form. The two forms are approximately equally represented in this sample which comprises small numbers from throughout the Tongan archipelago.

In the ZFMK collection there are 29 specimens of the *cyanura* species group collected by D.R. Rinke from two localities on 'Eua. These contain only one specimen of *pheonura*. More work is needed to explore the relative abundance of these two forms in Tonga and to confirm that they are separate species rather than polymorphs of one species.

AIM H1344, from Niufo'ou, is dark-coloured with a coppery sheen and lacks dorsal stripes. This is presumably the "bronze morph" of Crombie & Steadman (1986), and is the only such example from Tonga that we have seen. Some of the dorsal scales are fused, so it is assumed to be *cyanura* rather than *pheonura*.

DISCUSSION

All the non-endemic terrestrial reptiles of Tonga could owe their presence in Tonga, and their distribution within the archipelago, entirely to accidental or deliberate transport by humans. Polynesians first colonised Tonga just over 3,000 years ago (Davidson 1979). However, species with the most restricted distribution within the Tongan archipelago, such as *Emoia nigra* apparently limited to Niufo'ou and Niuatoputapu, and *E. murphyi* apparently restricted to those islands plus the Vava'u group, are the least likely to have been distributed by man.

The small species of *Emoia* (*E. cyanura* and *E. pheonura*) seemed to be at highest density on Late, which lacks feral chickens (*Gallus gallus*) and larger predatory skinks. On Niufo'ou, where *Emoia nigra* preys on its smaller congeners, the latter were most abundant in plantations. On 'Ata, where feral chickens are abundant, the small emoias were only moderately common. *Emoia trossula* was scarce on Tongatapu, compared with 'Eua where it is more common. This may be due to predation by cats, which are more numerous on Tongatapu, or to the greater use of insecticides on the latter. On Niufo'ou, *Emoia nigra* is almost entirely ground-dwelling. It was most common on islands in the crater lake. On the main island it occurred in both forest and plantations. On 'Ata, *Cryptoblepharus eximius*, one of only three reptile species found, was not confined to shoreline habitats, as on other islands, but also occurred with Blue-tailed Skinks on the cliffs up to 60-80 m a.s.l.

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NOTES ON COASTAL TIGER BEETLES (COLEOPTERA: CICINDELIDAE)

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Abstract. Following an earlier study (Wise 1988), two previously unseen publications are noted and *Neocicindela perhispidata* is discussed. A further locality record, on Great Barrier I, is given for *Neocicindela brevilunata*. This species is not known to occur further south on the east coast of the North I and *N. perhispidata* is not known to extend southwards on the west coast either on black ironsands or lighter coloured sands.

On dark ironsands of the North I west coast, the common land tiger beetle, *N. tuberculata*, has been found to forage with *N. perhispidata* var *campbelli* and to replace it further south.

The distribution of northern North Island tiger beetles occurring on sandy beaches and dunes of different colours has been recorded previously (Wise 1988). *Neocicindela perhispidata* (Broun, 1880) inhabits the west coasts from Kawhia northwards, around the northern tip and the east coast as far south as Karikari Peninsula. Three varieties occur, *campbelli* on the dark ironsands of the west coast, *perhispidata* on the creamy yellow sands further north and *giveni* on the far northern whiter sands and the eastern white quartz sands.

A paper by Hadley, Schultz & Savill (1988) was not seen by the present author until after his paper was published. These authors had examined the three entities of *N. perhispidata* (as subspecies) on the differently coloured sands of three well-separated localities and compared reflectances between the beetles and the sands they were on. While individuals of this species from particular areas may appear as distinct entities, beetles in and near change-zones (see Wise 1988) are sometimes difficult to place in either of the neighbouring entities, which is the reason for considering the entities as varieties rather than subspecies.

Another paper on North I Cicindelids, by Wiesner (1988), was published just after that by the author (Wise 1988) but has only been seen recently. Wiesner recorded species from his own collecting here during December 1987 — January 1988. He recorded three subspecies of *Neocicindela perhispidata* within the known range for each (see Wise 1988) but also named another subspecies, *N. perhispidata savilli*, for the tiger beetles on white quartz sand on the east coast of the northern peninsula (Rarawa). The present author can only reiterate the comment made above and further point out that there is wide variation in the pale colour and extent of markings on the elytra in this species.

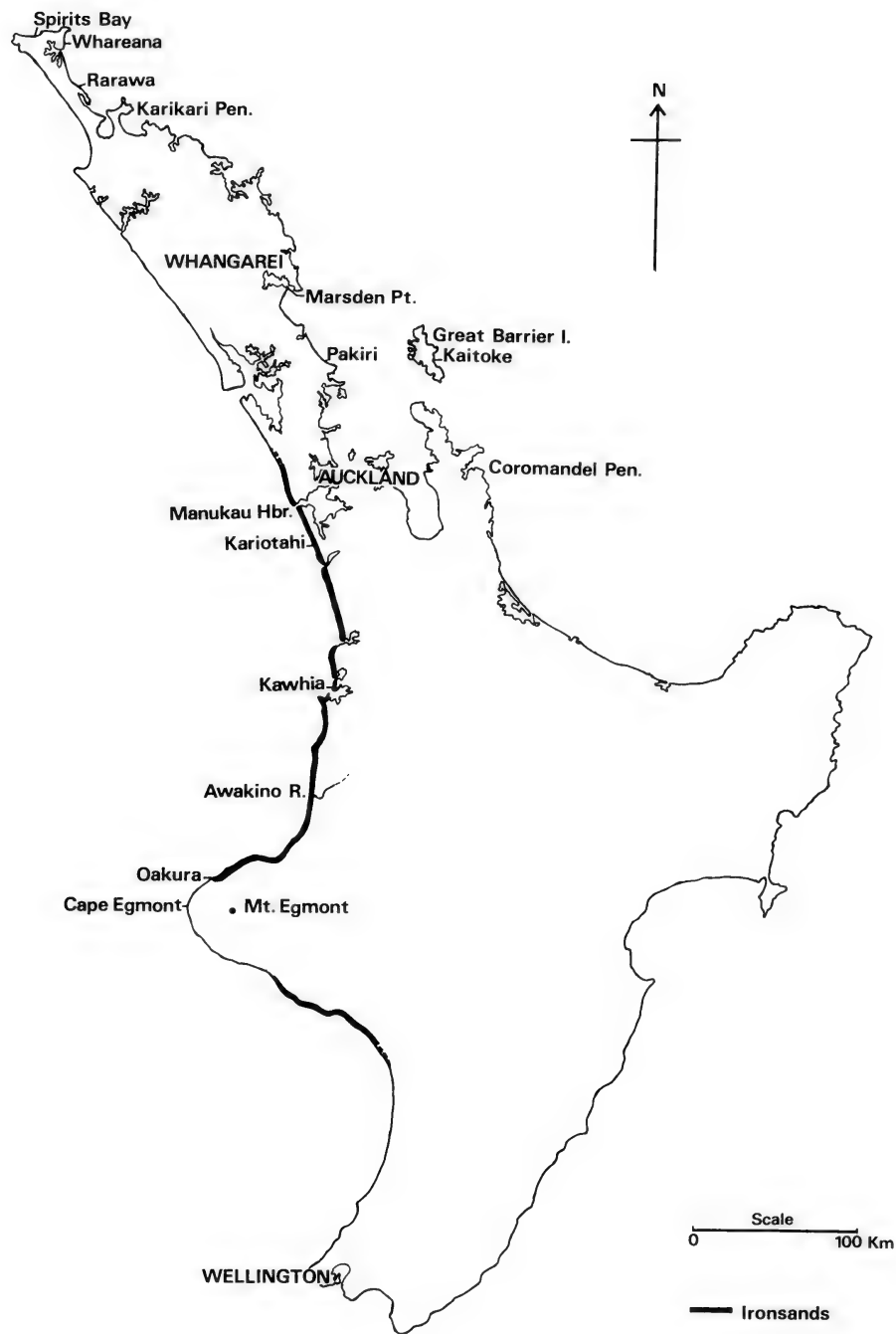


Fig. 1. Map of North Island, New Zealand, showing localities mentioned (ironsands after Williams 1974).

Four specimens of *N. perhispidata* were taken in December 1989 (coll. K.A.J.W.) at Whareana (Fig. 1) where the sand is darker than at both Spirits Bay on the north coast and further south as at Rarawa. Two males are with markings as on Rarawa specimens but two females have markings more as on some specimens from the northern west coast. Further, amongst 10 specimens previously recorded (Wise 1988) from Karikari Pen. (the southern limit of the species on the east coast), where the sand is darker than further north (Rarawa), there are indications also, on at least two specimens, of a reversal of dark markings back towards those of the northern west coast. If a criterion for subspecies is geographic separation, and there is none through the whole geographic range of *N. perhispidata*, only sand colour differences, then the variations do not warrant subspecific rank.

Another species, *Neocicindela brevilunata* (Horn, 1926) was shown (Wise 1988) to inhabit white sands on the east coast south of Whangarei Harbour, from Marsden Pt. southwards to Pakiri. This species is now found to occur also on Great Barrier I (Fig. 1) from specimens in the National Museum (Kaitoke Beach, Gt Barrier I, 17-29.I.1930, A.E. Brookes, 8 spec.). *N. brevilunata* has also been recorded by Wiesner (1988) within the known range at Marsden Pt and further south.

So far there is no indication that either of these species occurs further south on North I coasts. From personal searches and examination of specimens in collections it appears that there are no specialised coastal sand species on the various beaches from Coromandel Pen. southwards to the south coast and Wellington. The same applies on the west coast from the Awakino River southwards to Wellington.

There is one specimen of *N. perhispidata* var. *perhispidata* in the Horn Collection (ATIE) labelled "Wellington New Zealand" collected by "Baker". However, Horn, himself (1936:11), doubted the locality and Fuller Baker (op. cit.) was an entomologist visiting New Zealand.

The black ironsands, which originated from the Taranaki andesites of Mt Egmont (see Williams 1974), were spread northwards by ocean currents along the coast (Fig. 1). These gave rise to the dark variety of *N. perhispidata* known as *campbelli*. The dark ironsands are also present on the coast south of Mt Egmont but *campbelli* does not reach that far south. There is no occurrence, known to the author, of *N. perhispidata* further south on the lighter coloured sands of that coast.

However, it appears that the common land species of tiger beetles in New Zealand, *Neocicindela tuberculata*, is dark enough to survive on the dark ironsands. Where low banks are present above the beaches, individuals can be seen flying onto and running on the black sands in the process of foraging. The author has seen this activity on beaches between the Manukau Hbr (west of Auckland) and Cape Egmont (west of Mt Egmont). On beaches south of Awakino R to Oakura, *N. tuberculata* can be seen frequently in the summer. Farther north at Kariotahi, both *N. tuberculata* and *N. perhispidata* var. *campbelli* were foraging on the black sands together. Many individuals of both species have been seen there running and mixing on the sand while foraging, to the extent of body contact, although no attempt at inter-specific mating was seen.

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LACEWINGS AND AQUATIC INSECTS OF NEW ZEALAND

5. Trichoptera of North Auckland

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Abstract. Trichoptera species are listed, in a table, for Auckland and for North Auckland counties, from previous records and from identified adult specimens. Approximately 16 species are recorded in Auckland, 50 in Waitemata Co, eight others further north and one in "Northland". Total numbers indicate that slightly more than one third of the described New Zealand species occur in North Auckland.

The caddis-flies and the larval caddis (Trichoptera) have not, in the past, been recorded in the north as much as in areas further south. This report is intended to give an indication of the distribution of these insects in North Auckland as well as of the total fauna for this area. The Trichoptera fauna of northern off-shore islands has been recorded previously (Wise 1983).

The North Island of New Zealand is almost divided at Auckland (Fig. 1) where a very narrow isthmus lies between the Waitemata and Manukau Harbours. The area north of Auckland is commonly known as North Auckland or Northland. It is approximately 320 km in length, 90 km in greatest width and ca 12,600 sq km in area. The land is very dissected, mostly hilly, with several ranges and some peaks over 700 m in height. Rainfall averages 1200-1700 mm per annum and there are many rivers, streams and other bodies of water.

Records given here are for counties and Auckland city areas as delineated on New Zealand Map Series 138A, 3rd ed. 1 August 1964 (see Fig. 1). For the present purpose Whangarei City and various towns are included here within the county boundaries.

AUCKLAND AND NORTH AUCKLAND

Auckland city areas, with extensive suburbs, are included in order to indicate the restricted fauna within their boundaries.

Waitemata Co. stretches across the island, immediately north of Auckland city areas and Manukau Hbr, and includes the Waitakere Ranges on the western side. These ranges have been well collected and supply faunal records which act as a basic list for North Auckland.

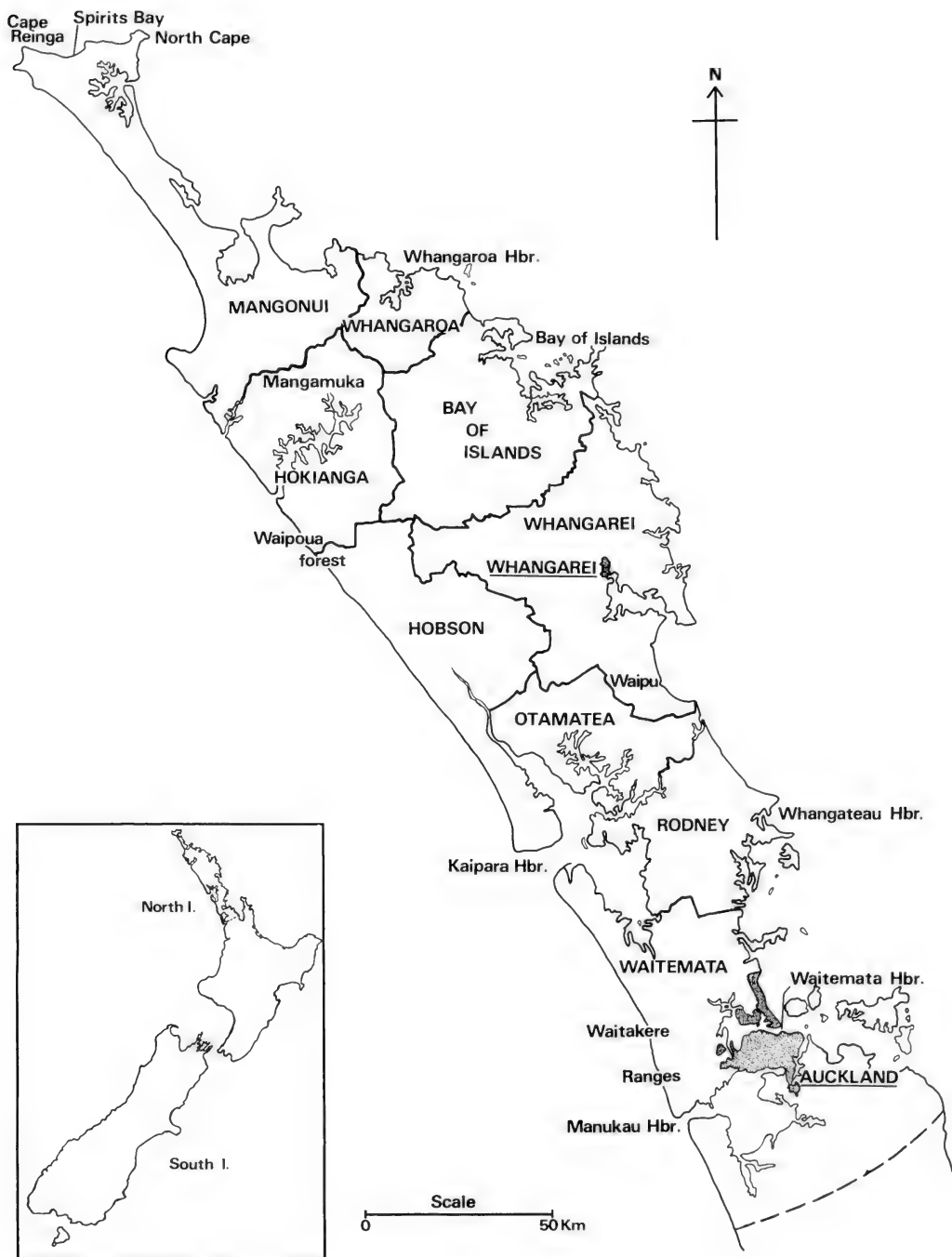


Fig. 1. Map of North Auckland showing Auckland and northern county boundaries (after NZMS 138A 3rd ed.), and some relevant place-names. Inset. New Zealand.

Rodney Co. lies between the southern Kaipara Hbr and the east coast. One collecting area is just within the southern border on the east coast and another further north around Whangateau Hbr.

Otamatea Co. lies between northern Kaipara Hbr and the east coast. It is a small county and there are few collecting records.

Hobson Co. is elongate along the west coast. Ranges in the north are covered by the Waipoua kauri forest which extends into the Hokianga Co, and the county boundary is, in part, the Waipoua River. Consequently, species recorded for Waipoua or the forest are here considered to occur in both counties but there are only three such records for this county.

Whangarei Co. is a large county to the east. Many records come from near Whangarei City which, at the northern end, lies between two small rivers. Specimens are also from Waipu caves and Waipu Gorge in the south of the county.

Hokianga Co. is north of Hobson Co. Its northern boundary lies along a range commonly known as "the Mangamukas" which drains, in part, into the Mangamuka Gorge within this county. Any record of Trichoptera from the Mangamuka area is taken as being associated with this drainage and river in Hokianga Co. Although most listed species occur in that area, species records from Waipoua forest and elsewhere in the county are included.

Bay of Islands Co. is to the east. Collecting has been concentrated about the Bay of Islands area where there are rivers and streams draining into this large bay.

Whangaroa Co., to the north on the east coast, is small and its northern boundary continues that of Hokianga Co. across the island. Collecting has mainly been done on the coast south of Whangaroa Hbr.

Mangonui Co. is the remainder of North Auckland, north of the Hokianga-Whangaroa Counties boundary. It includes a hilly mainland area, two low-lying northern peninsulas and a few on-shore (stranded) islands on those peninsulas. The biggest of these rocky on-shore islands stretches along the far northern coast between Cape Reinga and North Cape. Several streams there, particularly those draining into Spirits Bay, have provided Trichoptera records.

TRICHOPTERA FAUNA

The information presented here (Table 1) includes previously published records together with records of adult specimens, determined by the author, in the Auckland Museum collections and a few originally in the Plant Diseases Division (DSIR) collection (now in New Zealand Arthropod Collection of Plant Protection, Entomology).

Species were recorded previously by Wise (1958, 1962), McLean (1966) and particularly by Cowley (1976, 1978) and Towns (1978, 1979). Other records are from McFarlane (1951, 1960, 1964, 1966, 1976), Leader (1972), Riek (1977), and McFarlane & Cowie (1981).

Table 1. Distribution of Trichoptera for North Auckland, by counties, and Auckland.

Species	Auckland and counties*									
	Auc	Wai	Rod	Ota	Hob	Wei	Hok	BoI	Woa	Man
HYDROBIOSIDAE										
Hydrobiosis budgei		(Northland MF 60)†								
Hydrobiosis clavigera		To 78								
Hydrobiosis copis						NZAC				
Hydrobiosis parumbripennis		To 78								
		NZAC								
Hydrobiosis soror		To 78								
Psilochorema donaldsoni									MF 60	
Psilochorema macroharpax		To 78						+		
Psilochorema mimicum		+								
Psilochorema nemorale		To 78								
Edpercivalia borealis		MF 51						+		
		+								
Edpercivalia thomasoni		NZAC								
Neurochorema armstrongi		To 78				+				
Neurochorema confusum		To 78								
Hydrochorema crassicaudatum		To 78								
Atrachorema mangu							MF 64			
Costachorema hecton		To 78								
		NZAC								
Costachorema xanthoptera		To 78								
Tiphobiosis trifurca		+								
Tiphobiosis veniflex		To 78								
		NZAC								
HYDROPTILIDAE										
Oxyethira albiceps	Wi 58 Co 78 +	Co 78 To 78	+	+	Le 72 +	+	+		+	+
Paroxyethira hendersoni	Co 78 +	Co 78 To 78		+		+				+
Paroxyethira kimminsi		Le 72 To 78								
Paroxyethira tillyardi										+
PHILOPOTAMIDAE										
Hydrobiosella mixta		Co 76 Co 78 To 78 +				+				
Neobiosella irrorata						Wi 58 +				
HYDROPSYCHIDAE										
Orthopsyche fimbriata	Co 78	Co 78 To 78 +	Co 78			NZAC			Wi 58 +	Co 78

	Auc	Wai	Rod	Ota	Hob	Wei	Hok	BoI	Woa	Man
<i>Orthopsyche thomasi</i>		Wi 62 MF 76 Co 78 +								Co 78
<i>Aoteapsyche catherinae</i>								+		+
<i>Aoteapsyche colonica</i>	Co 78	Co 78 To 78 +	+	+		Co 78 +	+	+		Co 78 +
<i>Aoteapsyche raruraru</i>		Co 78 To 78 +	+			+		+		
<i>Diplectrona bulla</i>		+								
POLYCENTROPODIDAE										
<i>Plectrocnemia maclachlani</i>	Co 78	Co 78								+
<i>Polyplectropus altera</i>	Wi 58 Co 78 MC 81 +	Co 78 To 78 +	Co 78			NZAC		MC 81 +		
<i>Polyplectropus impluvii</i>	Wi 62 +		+				+	+		+
<i>Polyplectropus waitakerensis</i>		Wi 62 +								
ECNOMIDAE										
<i>Ecnomina zealandica</i>	Wi 58 +	Co 78 To 78								
PSYCHOMYIIDAE										
<i>Zelandoptila moselyi</i>		+	+		+	+	Wi 58 +			
CHATHAMIIDAE										
<i>Philanisus plebeius</i>	Co 78 NZAC	Co 78	Co 78 +	Ri 77		+	Co 78 +	+	+	+
<i>Chathamia integripennis</i>		+	+					Ri 77 +		
OECONESIDAE										
<i>Oeconesus maori</i>	Co 78	Co 78 To 78 +						+		
<i>Zepsyche acinaces</i>		+								
CONOESUCIDAE										
<i>Pycnocentria evecta</i>		Co 78 To 78	Co 78							
<i>Pycnocentria funerea</i>	Wi 58 +	To 78				+		+	+	
<i>Beraeoptera roria</i>		Co 78 To 78								
<i>Pycnocentrodes aeris</i>		Co 78 To 78				+				

	Auc	Wai	Rod	Ota	Hob	Wei	Hok	BoI	Woa	Man
<i>Pycnocentroides modesta</i>		ML 66 Co 76 Co 78 To 78 +			Co 78	ML 66 +		ML 66 +	+	Co 78 +
<i>Confluens hamiltoni</i>	Co 78	To 78 Co 78 To 79		MF 66						
<i>Conuxia gunni</i>										
<i>Olinga feredayi</i>		ML 66 Co 78 To 78			NZAC	ML 66 +	NZAC	ML 66 +		Co 78
CALOCIDAE										
<i>Alloeocentrella magnicornis</i>		Wi 58 Co 78 To 78 +				+				
HELICOPHIDAE										
<i>Zelolessica cheira</i>	Co 78	Co 78 To 78							+	+
HELICOPSYCHIDAE										
<i>Helicopsyche albescens</i>		To 78			+	+	+	+		
<i>Helicopsyche zealandica</i>		Co 78	Co 78 +						+	Co 78
LEPTOCERIDAE										
<i>Triplectides cephalotes</i>	Co 78 +	Co 78				Co 78	+			Co 78 +
<i>Triplectides obsoleta</i>	Co 78	Co 78 To 78 +				+		+		+
<i>Triplectidina</i> sp.n.†	Co 78 NZAC									
<i>Hudsonema aliena</i>	Co 78									
<i>Hudsonema amabilis</i>	Co 78	Co 78 To 78			+	Wi 58 +				Co 78
<i>Oecetis iti</i>										Co 78 +
<i>Oecetis unicolor</i>		Co 78						+		+

* Auc — Auckland, Wai — Waitemata, Rod — Rodney, Ota — Otamatea, Hob — Hobson, Wei — Whangarei, Hok — Hokianga, BoI — Bay of Islands, Woa — Whangaroa, Man — Mangonui.

† References. Author, year. Co — Cowley, Le — Leader, MF — McFarlane, MC — McFarlane & Cowie, ML — McLean, Ri — Riek, To — Towns, Wi — Wise.

Specimens. + — Auckland Museum, NZAC — NZ Arthropod Collection.

‡ Now *Triplectidina moselyi*, see McFarlane & Ward 1990. The total number of described species in New Zealand is now 162.

Species records are included in the list (Table 1) under their current names. Synonymies are not noted here but cases where new species names have replaced older ones, in the northern North I, are noted below in their respective families. These species combinations and the family classifications are as given in the *Atlas* by Neboiss (1986).

HYDROBIOSIDAE. In general this is a cold-water family which is well represented in the south of New Zealand. Although several species are recorded from Waitemata Co, only a few have been taken further north and the author has seen very few specimens from the more northern counties. Two species, *Psilochorema donaldsoni* McFarlane, 1960 and *Atrachorema mangu* McFarlane, 1964 have so far been recorded only from the original localities. A record of *Tiphobiosis montana* Tillyard, 1924 by Towns (1978) is here taken to be *T. veniflex* McFarlane, 1960 as the male genitalia are somewhat similar in lateral view and *T. montana* is still only known from the original South I specimens (McFarlane & Cowie 1981).

Specimens (in NZAC) previously determined by the present author as *Costacharema psaroptera* McFarlane, 1939, together with a record of that species by Towns (1978), are now considered to be *C. hecton* McFarlane, 1981 (in McFarlane & Cowie 1981) even though this species was described and figured from only one specimen taken in the southern South I.

HYDROPTILIDAE. *Oxyethira albiceps* (McLachlan, 1862) is very common and two species of *Paroxyethira* have been taken. The occurrence of *P. tillyardi* Mosely, 1924 at one locality in Mangonui Co is interesting as Leader (1972) recorded it as a highly local species known from only two well-separated southern sites.

PHILOPOTAMIDAE. Following an indication by Wise (1970) that the true *Hydrobiosella stenocerca* Tillyard, 1924 is a South I species, North I specimens previously thought to be that species are now recognised as a distinct species, *H. mixta* (Cowley, 1976).

HYDROPSYCHIDAE. One species, *Aoteapsyche colonica* (McLachlan, 1871), appears to be common in North Auckland and four others in *Aoteapsyche* and *Orthopsyche* also occur. *Diplectrona bulla* Wise, 1958 is recorded in Waitemata Co.

POLYCENTROPODIDAE. *Polyplectropus altera* McFarlane, 1981 (in McFarlane & Cowie 1981) was described for the species previously recorded as *P. puerilis* (McLachlan, 1868) in the north and records of the latter are included here under the former name. This and two other species appear to be widespread in North Auckland.

ECNOMIDAE. A record of *Ecnomina* sp. by Towns (1978) is here taken to refer to the one known New Zealand species.

PSYCHOMYIIDAE. The one known New Zealand species has been collected at several localities.

CHATHAMIIDAE. Two species of this family of marine littoral caddis occur along the east coast and one is here confirmed for the west coast in Hokianga Co.

OECONESIDAE. Only one species is known north of Waitemata Co.

KOKIRIIDAE. The one species in this family is in the South I.

CONOESUCIDAE. *Pycnocentrodes modesta* Cowley, 1976 was described for one of the northern species of the genus and replaces *P. aureola* (McLachlan, 1868), in the north (Cowley 1978). This and other species are widespread and common in North Auckland.

CALOCIDAE. Of the two New Zealand species now in this family, *Alloeocentrella magnicornis* Wise, 1958 was described from Waitemata Co and is now also known from Whangarei Co.

HELICOPHIDAE. Although McFarlane & Cowie (1981:382) commented that the *Zelolessica cheira* McFarlane, 1956 of Cowley (1978) should be *Z. meizon* McFarlane, 1981, this has been reversed by Winterbourn & Gregson (1989:41). The first species is here confirmed from adult specimens taken in northern North Auckland.

PHILORHEITHRIDAE. This family is not known from the northern North I.

HELICOPSYCHIDAE. Cowley (1978) commented that *Helicopsyche zealandica* Hudson, 1904 is the commonest species of the genus but, north of Waitemata Co, recorded it only from two coastal localities in Rodney and Mangonui Counties. Only a few specimens of the dark *H. zealandica* have been collected by the author, also near the coast, in Rodney and Whangaroa Counties. Cowley (1978) also inferred that *H. albescens* Tillyard, 1924 did not occur as far north as Auckland but the present author has found this pale species flying in large numbers near Whangarei (Whangarei Co) and at Mangamuka Gorge (Hokianga Co), and it occurs elsewhere. It should be noted that the outline figures of *H. albescens* male genitalia by Tillyard (1924) are more accurate than those of Mosely & Kimmins (1953).

LEPTOCERIDAE. Three species are common and widespread in North Auckland. One other species, *Oecetis iti* McFarlane, 1964, is, so far, only recorded from the South I and Mangonui Co in North Auckland, where it is now known from two localities.

The situation concerning previous records and identifications of *Triplectidina oreolimnetes* (Tillyard, 1924) is complex and remains to be elucidated. Wise (1970) recorded that the types of this species are not the same as those described under this name as type species of *Triplectidina* Mosely, 1936 (see Mosely & Kimmins 1953). He has since examined the specimens available to Mosely in the British Museum (Natural History) Entomology collection and found that a paratype specimen is the true *T. oreolimnetes* but others (particularly North I specimens) are the species Mosely described and figured, with a short fold in the male forewing. Specimens from Waitemata Co previously identified as *Triplectidina* (or *Triplectides*) *oreolimnetes* are found not to be that species and are here recorded, together with records of that species by Cowley (1978), as "*Triplectidina* sp.n."

DISCUSSION

Not all species records in Table 1 are confirmed for Auckland and North Auckland but even if a few species names are misidentifications the number of species may remain the same or there may still be species to be found. Sixteen species are recorded for Auckland but one is not recorded in the counties to the north. The Waitemata Co list includes 50 species, eight more species occur further north and there is one record for "Northland". The ca. 59 species listed indicate that just over one third of the 161 species presently described for New Zealand occur in North Auckland.

Acknowledgements. Some identifications recorded were originally made while the author was a staff member of Plant Diseases Division, D.S.I.R., Auckland, up to 1960. Recent access to collections has kindly been given by Drs Peter Barnard, British Museum (Natural History) Entomology, London, and Trevor Crosby, Plant Protection Entomology, Auckland.

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LACEWINGS AND AQUATIC INSECTS OF NEW ZEALAND

6. Gerroidea (Hemiptera:Heteroptera) in North Auckland

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Abstract. *Microvelia macgregori* (Veliidae), *Hydrometra risbeci* (Hydrometridae) and *Mesovelia* sp. (Mesoveliidae) are accepted as the three semi-aquatic bugs (Gerroidea) on fresh water in New Zealand and all occur through North Auckland. *Mniovelia kuscheli*, the New Zealand terrestrial Mesoveliid is also noted for North Auckland.

This Part, in the series, records semi-aquatic bugs (Gerroidea) in North Auckland, which is defined as in Part 5 (Wise 1990, this volume) where the counties are also indicated.

Family VELIIDAE

Microvelia macgregori (Kirkaldy, 1899)

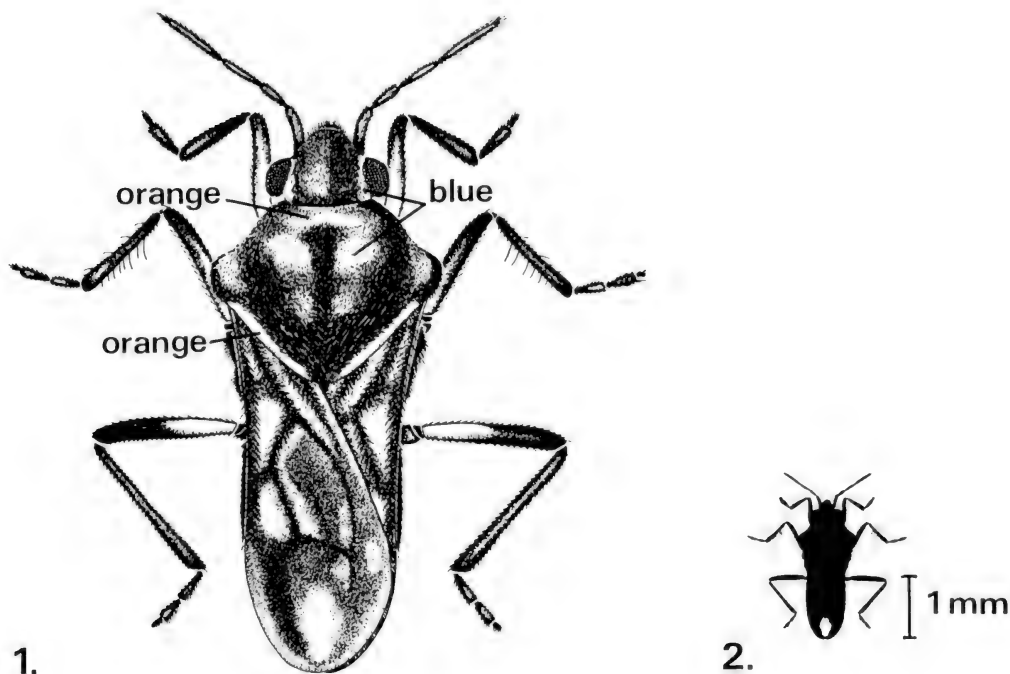
This species of pond skater has been established as the only species of Veliidae in New Zealand (Don 1967, Malipatil 1980).

The common apterous (wingless) form of the species occurs throughout North Auckland, including the far north (Mangonui Co).

Myers (1922) described the alate (winged) form and recorded it as abundant on alpine tarns in the Tararua Range (southern North Island) at ca. 1372 m (4500 ft) but extremely rare in the lowlands. In February (summer) he had found only alates on the tarns and he intimated that the occurrence of the winged form there and the wingless form in the lowlands was a function of altitude.

Alates have been collected by the author in North Auckland and elsewhere at low altitudes, for many years, though in very small numbers compared with the numbers of apterous individuals. However, in December 1989, on the far north peninsula (Mangonui Co), the author found a colony which appeared to be made up of alates (24 spec. coll K.A.J.W.) and immatures. This was on a man-made pond, in low-lying coastal pine forest at Hukatere, near Pukenui, which had been examined and collected previously during several years when no such numbers had been seen. It would appear that climate, altitude or distance from the coast are not factors in the production of alates, but either season (summer) or overcrowding may affect local populations.

The winged form of *Microvelia macgregori* is easily recognised (Fig. 1). The head and thoracic colouring is the same as the wingless form but the folded wings are dark and exhibit several dull white flashes and a more noticeable posterior oval white spot. On the water surface, an alate (Fig. 2) is seen as dark with the rounded posterior outline of the folded wings (not tapered as is the exposed body of the apterous form) and with the posterior oval white spot clearly visible at close quarters.



Figs. 1,2. *Microvelia macgregori* (Kirk., 1899). 1. Alate form (magnified). 2. Alate as seen on water surface.

Family HYDROMETRIDAE

Hydrometra risbeci Hungerford, 1938

This species of water measurer is widely spread through North Auckland. It was collected by the author, during December 1989, in the far north (Mangonui Co) at Te Werahi swamp, south of C. Reinga, and at Whareana, south of North Cape. The alate form (figured by Pendergrast & Cowley 1966) has been found at Auckland and probably occurs further north occasionally.

Family MESOVELIIDAE

In a brief note, Pendergrast (1959) recorded that a semi-aquatic and a terrestrial species of this family were present in New Zealand (both in North Auckland).

Mesovelias sp.

The semi-aquatic species of Mesoveliidae was recorded by Pendergrast (1959) from a pond near Kaikohe (western Bay of Islands Co). Pendergrast & Cowley (1966) noted the Kaikohe occurrence and also collections from ponds near Auckland.

Under the name of *Mesovelias* sp., a species was recorded and figured by Towns (1978) from one winged specimen taken on Waitakere River (Waitemata Co).

The present author has, in the past, found *Mesovelias* colonies at the edge of a swampy lake elsewhere in Waitemata Co and at Te Werahi swamp in Mangonui Co (specimens are on loan overseas). In December 1989, the Te Werahi colony was re-collected, after a period of many years, but only apterous individuals were found.

Mniovelias kuscheli Anderson & Polhemus, 1980

This, the only other New Zealand Mesoveliid, is a terrestrial species mostly associated with moss and leaf litter. It was recorded by Pendergrast (1959) from the Waitakere Ranges (Waitemata Co), and elsewhere (outside North Auckland). Anderson & Polhemus (1980) gave many localities between Auckland and North Cape.

CONCLUSION

There is thus one species of freshwater semi-aquatic bugs in each of the three Gerroid families present in New Zealand, although one species is still undetermined. All three species, represented by apterous adults and immatures, are present in North Auckland, as are probably alate adults from time to time.

Acknowledgements. Peter Quin (previously of Auckland Museum) drew Fig. 1 and Rosemary Gilbert (Auckland Museum) prepared the figures for publication.

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